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CHINESE FUNGI COLLECTED BY S. Y. CHEO

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The fungi enumerated below were collected in various parts of China by S. Y. Cheo, and were kindly forwarded to the writer by Dr. D. H. Linder from the Farlow Herbarium, Harvard University, to which herbarium the type specimens have been returned.

1. *Irene calostroma* (Desm.) Hoehn. Ann. Mycol. **16**: 213. 1918.

FIGURE 1

On *Rubus* sp., Kwangsi Province, Lao Shan, Ling Yui Hsien, 13.3.1933, *Cheo* 1615a.

Colonies epiphyllous, rarely also hypophyllous, black, thin, orbicular, scattered, up to 3 mm. diam., sometimes confluent, not causing leafspots. Mycelium of substraight dark brown hyphae 6–8 μ thick, the cells mostly 25–40 μ long, branching opposite or irregular at 45–90°, loosely reticulate. Capitulate hyphopodia alternate, more or less antrorse, straight or bent, 25–38 μ long, stalk cell cuneate 10–16 μ long, head cell irregularly 3–5-lobed, 12–20 x 12–20 μ . Mucronate hyphopodia few, scattered, mostly alternate, squat ampulliform, 13–18 x 7–8 μ , neck short 3–4 μ thick. Perithecia loosely scattered, black, globose, 200–250 μ diam., with 6–10 suberect larviform appendages, cylindric with bluntly conoid apex, more or less bent, dark brown, transversely striate, continuous, up to 70 μ long by about 20 μ thick at the base. Spores bent cylindric with rounded ends, dark brown, 3-septate, constricted, 41–51 x 13–15 μ (average 47 x 13.5 μ).

2. *Irene styracicola* Yamamoto, var. *minor* var. nov.

FIGURE 2

Plagulae epiphyllae atrae orbiculares leves, usque ad 1 mm. diam., vel confluentes. Mycelium ex hyphis atrobrunneis sinuosis 6–7 μ crassis (cellulis plerumque circa 25 μ longa) oppositae vel irregulariter ramosae (45–90°) laxae reticulatae compositum. Hyphopodia capitata alternata, 16–36 μ longa, recta vel curvula, plus minusve antrorsa, cellula basali cuneata vel cylindracea, 4–20 μ longa, recta vel curvata, cellula apicali raro ovata integraeque, plerumque 3–4-angulosa vel sub-3–4-lobata, 12–17 x 11–18 μ .

Hyphopodia mucronata pauca dispersa alternata ampullacea 14–20 x 7–8 μ , collo brevi 3.5–4 μ crasso. Setae myceliales nullae. Perithecia in centro plagularum laxae aggregata, atra globosa usque ad 220 μ diam., appendicibus corniformis 5–12, suberectis 40–60 μ longis et basi 20–30 μ crassis, superne attenuatis, apice obtusis hamatis, continuis, tenuiter tunicatis, brunneis, transverse striatis ornata. Sporae ellipsoideae utrinque rotundatae, atrobrunneae, curvulae, 3-septatae, constrictae 38–44 x 12–15 μ (av. 41.5 x 14 μ).

Hab. in foliis *Styracis benzoin*, Kweichow Province, Liang Feng Yah, Tsunyi Hsien, 31.7.1931, *Cheo* 180 p.p.

Colonies epiphyllous black orbicular smooth, on pale reddish brown leafspots not visible through the leaf, up to 1 mm. diam., or confluent, mixed with those of *Meliola kweichowensis* Hansf. Mycelium of somewhat sinuous dark brown hyphae 6–7 μ thick, the cells mostly about 25 μ long, branching opposite or irregular at 45–90°, loosely reticulate. Capitate hyphopodia alternate, 16–35 μ long, straight or bent; stalk cell cuneate to cylindric, 4–20 μ long, straight or bent; head cell rarely ovate and entire, usually 3–4-angled or shallowly 3–4-lobed, 12–17 x 11–18 μ . Mucronate hyphopodia few, scattered amongst the capitate hyphopodia, alternate, ampulliform, 14–20 x 7–8 μ , with short neck 3.5–4 μ thick. Perithecia in a loose central group, black globose, up to 220 μ diam., with 5–12 suberect larviform appendages 40–60 μ long by 20–30 μ thick at the base, attenuate to the blunt hamate apex, with thin brown transversely striate wall, apparently not septate, arising from the sides and upper half of the perithecial wall. Spores bent ellipsoid with rounded ends, dark brown, 3-septate, constricted, 38–44 x 12–15 μ (average 41.5 x 14 μ).

3. *Irenopsis benguetensis* Stev. & Rold. Philipp. Journ. Sci. 56: 49, 1935.

FIGURE 3

On *Ficus* sp., Kwangsi Province, Ling Wang Shan (San Kiang Hsien) 17.9.1933, *Cheo* 2784.

We have not seen type material from the Philippines for direct comparison with the present collection, which appears to satisfy the original description: —

Colonies amphigenous, black, 1–3 mm. diam., or numerous and confluent, thin. Mycelium of dark brown slightly sinuous hyphae 7–9 μ thick, the cells mostly 25–35 μ long, branching alternate at 45–90°, loosely reticulate. Capitate hyphopodia alternate, straight or bent, 22–37 μ long, stalk cell cuneate to cylindric, 6–20 μ long, head cell from subglobose to irregularly and shallowly 3–4-lobed 13–20 x 12–17 μ . Mucronate hyphopodia none in some colonies, in others numerous, on separate hyphae, alternate, rarely opposite, ampulliform, straight or bent, 19–25 x 7–10 μ , neck 4 μ thick. Mycelial setae none. Perithecia scattered, black, globose 120–150 μ diam., with 3–10 erect or spreading, black, straight or bent setae 80–160 x 9–10 μ , attenuate to 6–7 μ at the simple bent (not hamate or coiled) apex, 4–5-septate, rough scaly. Spores cylindric dark brown with rounded ends, 4-septate constricted 37–43 x 14–17 μ (av. 39 x 15.5 μ). The perithecial setae are formed at a very early stage in the development of the perithecia.

4. *Irenina Buddleiae*, sp. nov.

FIGURE 4

Plagulae amphigenae, plerumque epiphyllae, orbiculares densae atrae, circa 1 mm. diam., saepe numerosae et plus minusve confluentes. Mycelium ex hyphis atrobrunneis sinuosis 7–8 μ crassis, (cellulis plerumque circa 20 μ longis) oppositae vel irregulariter ramosis (60–90°) dense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, 18–31 μ longa, cellula basali cylindracea 5–15 μ longa, cellula apicali subglo-

bosa vel clavata, integra 13–18 x 9–15 μ . Hyphopodia mucronata pauca, in hyphis distinctis evoluta, opposita vel alternata, ampullacea, plus minusve curvata 12–17 x 6–7 μ , collo 3 μ crasso. Perithecia in centro plagarum laxae aggregata, atra globosa, usque ad 175 μ diam., cellulis parietis conoideis vel mammillatibus, usque ad 30 μ alt., raro in processibus cylindraceis usque ad 40 μ alt. productis. Setae nullae. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4-septatae constrictae 33–37 x 13–16 μ (av. 35 x 14.5 μ).

Hab. in foliis *Buddleiae* sp., Kwangsi Province, Ta Tseh Shan (Yung Hsien) 29.10.1933, *Cheo* 2940.

Colonies amphigenous, mostly epiphyllous, orbicular, about 1 mm. diam., dense, often numerous and more or less confluent over the leaf. Mycelium of dark brown sinuous hyphae 7–8 μ thick, the cells mostly about 20 μ long, branching opposite or irregular at 60–90°, closely reticulate. Capitate hyphopodia alternate, straight or bent, 18–31 μ long; stalk cell cylindric 5–15 μ long; head cell subglobose to clavate, entire, 13–18 x 9–15 μ . Mucronate hyphopodia few, on separate hyphae, opposite or alternate, ampulliform, more or less bent, 12–17 x 6–7 μ neck 3 μ thick. Setae none. Perithecia in a loose central group, black, globose, up to 175 μ diam., the surface cells about 35 μ diam., conoid to mammillate and up to 30 μ high, rarely produced into short cylindric processes up to 40 μ high. Spores dark brown, cylindric with rounded ends, 4-septate constricted 33–37 x 13–16 μ (average 35.5 x 14.5 μ).

5. (?) *Irenina Castanopsidis* sp. nov.

FIGURE 5

Plagulae amphigenae, plerumque epiphyllae, atrae, leves densae, usque ad 7 mm. diam., interdum confluentes. Mycelium ex hyphis atrobrunneis subrectis vel leniter sinuosis 8–9 μ crassis, (cellulis plerumque 20–30 μ longis) oppositae ramosis (60–90°) dense reticulatis compositum. Hyphopodia capitata alternata, suberecta vel antrorsa, recta vel curvata, 22–40 μ longa, cellula basali cylindracea 8–12 μ longa, cellula apicali irregulariter cylindracea, saepe fortiter curvata, lobata, 18–30 x 12–16 μ . Hyphopodia mucronata pauca, alternata vel opposita, dispersa, curvata ampullacea 16–22 x 8 μ , collo 3–4 μ crasso. Setae nullae. Perithecia matura non visa. Sporae atrobrunneae, oblongo-ellipsoideae utrinque late rotundatae, 4-septatae, constrictae, 46–53 x 22–25 μ (av. 49 x 23 μ).

Hab. in foliis *Castanopsidis tibetanae*, Kweichow Province, Ma Tsao Ho, Chiang K'ou Hsien, Fan Ching Shan, 25.10.1931, *Cheo* 758.

Colonies amphigenous, mostly epiphyllous, black smooth dense, up to 7 mm. diam., sometimes confluent. Mycelium of dark brown substraight to slightly sinuous hyphae 8–9 μ thick, the cells mostly 20–30 μ long, branching usually opposite at 60–90°, closely reticulate. Capitate hyphopodia alternate, at wide angles or somewhat antrorse, straight or bent, 22–40 μ long; stalk cell cylindric 8–12 μ long; head cell very irregularly cylindric, often much bent, lobate, 18–30 x 12–16 μ . Mucronate hyphopodia few, scattered amongst the capitate, alternate or opposite, bent ampulliform 16–22 x 8 μ , neck 3–4 μ thick. Mature perithecia not seen. Spores dark brown, oblong-ellipsoid with broadly rounded ends, 4-septate, strongly constricted, 46–53 x 22–25 μ (average 49 x 23 μ).

Further collections of this species are needed to establish with certainty to which of the genera *Irene*, *Irenopsis* and *Irenina* it belongs.

6. *Irenina Cheoi* sp. nov.

FIGURE 6

Plagulae amphigenae atrae densae orbiculares, usque ad 4 mm. diam., vel. confluentes, in hypophyllo saepe marginaliter extensae. Mycelium ex hyphis atrobrunneis rectis $7-9\mu$ crassis (cellulis $20-30\mu$ longis) oppositae denseque ramosis ($30-60^\circ$) dense reticulatis compositum, subsolidum. Hyphopodia capitata alternata antrorsa, recta vel curvata, $17-37\mu$ longa, cellula basali cylindracea recta vel curvata $4-17\mu$ longa, cellula apicali irregulariter stellatim $3-5$ -lobata, versiformia $10-22 \times 12-21\mu$. Hyphopodia mucronata pauca dispersa alternata ampullacea, plus minusve curvata $14-20 \times 7-9\mu$, collo brevi 4μ crasso. Setae nullae. Perithecia dispersa atra globosa $200-290\mu$ diam., cellulis parietis mammillatibus vel in processibus conoideis usque ad 40μ alt. productis, circa 40μ diam. Sporae atrobrunneae ellipsoideae utrinque rotundatae, curvulae, 3-septatae, leniter constrictae $48-56 \times 20-22\mu$ (av. $52 \times 21\mu$).

Hab. in foliis *Fici* sp. indet., Kweichow Province, Ma Tsao Ho (Chiang K'ou Hsien) (Fan Ching Shan), 16.10.1931, *Cheo* 715.

Colonies amphigenous, black, dense, orbicular, up to 4 mm. diam. or confluent, on the lower surface often elongate along the leaf margin. Mycelium of dark brown straight hyphae $7-9\mu$ thick, the cells mostly $20-30\mu$ long, branching opposite, close, at $30-60^\circ$, densely reticulate, almost solid. Capitae hyphopodia alternate, more or less antrorse, straight or bent, $17-37\mu$ long; stalk cell cylindric, straight or bent, $4-17\mu$ long; head cell irregularly stellately $3-5$ -lobed, variable in shape and size, $10-22 \times 12-21\mu$. Mucronate hyphopodia few, scattered amongst the capitae, alternate, ampulliform more or less bent, $14-20 \times 7-9\mu$, neck short 4μ wide. Setae none. Perithecia scattered black globose $200-290\mu$ diam., the surface cells mammillate or with bent conoid processes up to 40μ high, the cells about 40μ diam. at the base. Spores dark brown, bent ellipsoid with rounded ends, 3-septate, slightly constricted, $48-56 \times 20-22\mu$ (average $52 \times 21\mu$).

7. *Irenina Lonicerae* sp. nov.

FIGURE 7

Plagulae amphigenae plerumque epiphyllae, atrae orbiculares 1-2 mm. diam. vel numerosae confluentesque. Mycelium ex hyphis atrobrunneis subrectis vel leniter sinuosis $7-9\mu$ crassis (cellulis plerumque $20-25\mu$ longis) oppositae vel irregulariter ramosis ($45-60^\circ$) laxae vel subdense reticulatis compositum. Hyphopodia capitata alternata, plus minusve antrorsa, recta vel curvata $17-24\mu$ longa, cellula basali cuneata vel cylindracea, recta vel curvata, $4-8\mu$ longa, cellula apicali subglobosa, late clavata vel plerumque 3-angulosa vel sub-3-lobata, $12-17 \times 9-15\mu$. Hyphopodia mucronata in hyphis paucis inter hyphopodia capitata interspersa, opposita, plus minusve curvata ampullacea $15-22 \times 7-9\mu$, collo elongato 3μ crasso. Perithecia in centro plagarum aggregata, atra globosa usque ad 170μ diam., cellulis parietis mammillatibus, circa 40μ diam. et usque ad 25μ alt. Sporae atrobrunneae cylindraceae vel ellipsoideae utrinque rotundatae, 4-septatae constrictae $35-42 \times 15-17\mu$ (av. $38 \times 16\mu$).

Hab. in foliis *Lonicerae* sp. indet., Kweichow Province, Miao Wang (Chiang K'ou Hsien) (Fang Ching Shan) 27.9.1931, *Cheo* 605.

Colonies amphigenous, mostly epiphyllous, black, rounded, 1-2 mm. diam. or numerous and confluent. Mycelium of dark brown substraight to somewhat sinuous hyphae $7-9\mu$ thick, the cells mostly $20-25\mu$ long, branching opposite or irregular at $45-60^\circ$, loosely to closely reticulate. Capitae hyphopodia alternate, more or less antrorse, straight or bent,

17–24 μ long; stalk cell cuneate to cylindric, straight or bent, 4–9 μ long; head cell subglobose, wide clavate or more usually shallowly 3-angled to sublobed, 12–17 x 9–15 μ . Mucronate hyphopodia on few hyphae, mixed with capitate, usually opposite, more or less bent ampulliform, 15–22 x 7–9 μ , neck elongate 3 μ thick. Perithecia in a central group, black globose, up to 170 μ diam.; surface cells mammillate, about 40 μ diam, and up to 25 μ high. Spores dark brown, cylindric to subellipsoid with rounded ends, 4-septate constricted 35–42 x 15–17 μ (average 38.5 v 16 μ).

8. *Irenina quercina* sp. nov.

FIGURE 8

Plagulae epiphyllae, raro etiam hypophyllae, atrae orbiculares, densae leves, usque ad 5 mm. diam., numerosae et interdum confluentes. Mycelium ex hyphis atrobrunneis subrectis 7–8 μ crassis (cellulis plerumque 12–20 μ longis) oppositae ramosis (60–90°) densissime reticulatis compositum. Hyphopodia capitata alternata (rarissime opposita) 17–23 μ longa, late antrorsa, cellula basali cylindracea 3–7 μ longa cellula apicali cylindracea vel leniter clavata, integra vel raro irregulariter angulosa vel sublobata, apice plerumque late rotundata, 12–17 x 8–14 μ , recta vel curvata. Hyphopodia mucronata rara alternata ampullacea 17–21 x 7–9 μ , collo curvato 3–4 μ crasso. Setae nullae. Perithecia in centro plagularum laxae aggregata, atra globosa 200–250 μ diam, cellulis parietis obtuse conoideis, circa 35 μ diam., usque ad 15 μ alt. Sporae ellipsoideae atrobrunneae utrinque rotundatae, 4-septatae, fortiter constrictae 45–53 x 18–23 μ (av. 49 x 21 μ).

Hab. in foliis *Quercus* sp., Anhwei Province, Hai Hung Ling, Ch'ing Yang Hsien, Chiu Hua Shan, 14.11.1932, *Cheo* 1554.

Colonies epiphyllous, very rarely also hypophyllous, black orbicular dense smooth, up to 5 mm. diam., numerous and sometimes confluent. Mycelium of substraight dark brown hyphae 7–8 μ thick, the cells mostly 12–20 μ long, branching opposite at 60–90°, very densely reticulate. Capitate hyphopodia alternate (very rarely opposite) 17–23 μ long, at wide angles; stalk cell cylindric 3–7 μ long; head cell cylindric to slightly clavate, entire or rarely somewhat irregularly angulose to sublobed, apex usually widely rounded 12–17 x 8–14 μ , straight or bent. Mucronate hyphopodia very few, ampulliform, alternate, 17–21 x 7–9 μ , neck bent, 3–4 μ thick. Setae none. Perithecia in a loose central group, black, globose 200–250 μ diam., the surface cells bluntly conoid, about 35 μ diam. and up to 15 μ high. Spores ellipsoid, dark brown, with rounded ends, 4-septate rather strongly constricted, 45–53 x 18–23 μ (average 49.5 x 21 μ).

9. *Irenina Rosae* sp. nov.

FIGURE 9

Plagulae epiphyllae atrae dispersae orbiculares usque ad 2 mm. diam., saepe numerosae confluentesque, tenues vel subdensae. Mycelium ex hyphis atrobrunneis, sinuosis vel flexuosis 6–7.5 μ crassis (cellulis plerumque 20–25 μ longis) oppositae vel irregulariter ramosis (45–90°) laxae vel subdense reticulatis compositum. Hyphopodia capitata alternata saepe irregulariter curvata, 15–22 μ longa, cellula basali cylindracea vel cuneata, recta vel curvata 3–10 μ longa, cellula apicali versiformia, recta vel curvata, ex clavata integraque irregulariter 3-angulosa vel sublobata, apice rotundata acuta vel late truncata, 9–15 x 8–14 μ . Hyphopodia mucronata dispersa, interdum numerosissima, alternata, plus minusve curvata, conoidea vel ampullacea, 13–20 x 7–8 μ , collo 3–3.5 μ crasso. Setae nullae. Perithecia dispersa, atra globosa verrucosa 200–240 μ diam., cellulis parietis obtuse conoideis vel mammillatibus, circa 45 μ diam. usque ad 20 μ alt. Sporae

atrobrunneae cylindraceae utrinque rotundatae, plus minusve curvatae, 3-septatae, leniter constrictae $34-40 \times 11-13\mu$ (av. $37 \times 12\mu$).

Hab. in foliis *Rosae roxburghii*, Kweichow Province, Ta Ho Yen (Chiang K'ou Hsien) (Fan Ching Shan) 14.9.1931, *Cheo* 473. (**typus**); Kweichow Province, Liang Feng Yah (Taunyi Hsien) 1.8.1931, *Cheo* 184; *loc. cit.* 31.7.1931, *Cheo* 172.

Colonies epiphyllous black scattered rounded, up to 2 mm. diam., or numerous and subconfluent, thin to subdense. Mycelium of crooked or sinuous dark brown hyphae $6-7.5\mu$ thick, the cells mostly $20-25\mu$ long, branching opposite or irregular at $45-90^\circ$, loosely to rather closely reticulate. Capitulate hyphopodia alternate, usually more or less irregularly bent, $15-22\mu$ long; head cell cylindric to cuneate, straight or bent, $3-10\mu$ long; head cell very variable, straight or bent, from clavate to irregularly triangular or sublobed, apex rounded, acute or broadly truncate, $9-15 \times 8-14\mu$. Mucronate hyphopodia scattered, in some colonies exceeding the capitulate hyphopodia; alternate, more or less bent, conoid to ampulliform, $13-20 \times 7-8\mu$ the neck $3-3.5\mu$ thick. Perithecia scattered black globose verrucose $200-240\mu$ diam., the surface cells bluntly conoid to mammillate, about 45μ diam. and up to 20μ high; appendages none. Spores dark brown, cylindric with rounded ends, more or less bent, 3-septate, slightly constricted $34-40 \times 11-13\mu$ (average $37 \times 12\mu$).

10. *Meliola Actinodaphnes* sp. nov.

FIGURE 10

Plagulae amphigenae atrae densae orbiculares, usque ad 4 mm. diam. Mycelium ex hyphis atrobrunneis, in epiphyllis subrectis, in hypophyllo flexuosis vel geniculatis, $8-11\mu$ crassis (cellulis plerumque $15-25\mu$ longis) opposita ramosis ($60-90^\circ$) dense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, $20-38\mu$ longa, suberecta vel leniter antrorsa, cellula basali cylindracea $5-14\mu$ longa, cellula apicali cylindraceo-clavata vel irregularia, apice rotundata vel truncata, recta vel varie curvata, $11-25 \times 11-19\mu$. Hyphopodia mucronata dispersa, alternata vel opposita, breviter ampullacea, $14-22 \times 8-11\mu$, collo curvato 4μ crasso. Setae myceliales dispersae et juxta perithecia aggregatae, erectae rectae atrae simplices acutae, usque ad $800 \times 10-11\mu$. Perithecia dispersa atra globosa verrucosa usque ad 240μ diam. Sporae atrobrunneae ellipsoideae utrinque rotundatae, 4-septatae constrictae $52-65 \times 23-28\mu$ (av. $58 \times 26\mu$).

Hab. in foliis *Actinodaphnes* sp., Kwangsi Province, Loh Hoh Tsuen, Ling Yuin Hsien, 13.3.1933, *Cheo* 1608.

Colonies amphigenous black dense orbicular, up to 4 mm. diam. Mycelium on upper surface of substraight hyphae, on lower surface the hyphae very crooked to geniculate, dark brown $8-11\mu$ thick, the cells mostly $15-25\mu$ long; branching mostly opposite at $60-90^\circ$, closely reticulate. Capitulate hyphopodia alternate, straight or bent, $20-38\mu$ long; stalk cell cylindric $3-14\mu$ long; head cell cylindric-clavate to irregular, rounded or truncate at the apex, straight or variously bent $11-25 \times 11-19\mu$. Mucronate hyphopodia scattered amongst the capitulate, alternate or opposite, squat ampulliform, $14-22 \times 8-11\mu$, with bent neck 4μ thick. Mycelial setae scattered and also grouped around the perithecia, erect straight simple black acute up to 800μ long, $10-11\mu$ thick at the base. Perithecia scattered, black globose verrucose, up to 240μ diam. Spores dark brown,

ellipsoid with rounded ends, 4-septate, constricted $52-65 \times 23-28\mu$ (average $58 \times 26\mu$).

✓ 11. **Meliola Brandisiae** sp. nov.

FIGURE 11

Plagulae epiphyllae atrae subdenses 2-4 mm. diam. vel confluentes, subvelutinae. Mycelium ex hyphis atrobrunneis, subrectis vel leniter undulatis $7-8\mu$ crassis (cellulis $20-30\mu$ longis) opposita ramosis ($45-90^\circ$) dense reticulatis compositum. Hyphopodia capitata alternata, plerumque recta, $18-28\mu$ longa, cellula basali cuneata $8-10\mu$ longa, cellula apicali ovata vel clavato-cylindracea, integra, apice late rotundata, $12-19 \times 8-11\mu$. Hyphopodia mucronata in hyphis paucis inter hyphopodia capitata interspersa, opposita vel alternata, breviter ampullacea $13-18 \times 6-7\mu$, collo 3μ crasso. Setae myceliales modice numerosae, dispersae et juxta perithecia aggregatae, erectae rectae simplices atrae $200-300 \times 7-8\mu$ obtusae. Perithecia dispersa atra globosa verrucosa usque ad 170μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4-septatae constrictae $34-40 \times 13-16\mu$ (av. $36 \times 14.5\mu$).

Hab. in foliis *Brandisiae* sp., Kwangsi Province, Loh Hoh Tsuen, Ling Yuin Hsien, 13.3.1933, *Cheo* 1624.

Colonies epiphyllous, black, rather dense, 2-4 mm. diam., or confluent. Mycelium of substraight or slightly undulate dark brown hyphae $7-8\mu$ thick, the cells $20-30\mu$ long, branching opposite at $45-90^\circ$, closely reticulate. Capitulate hyphopodia alternate, usually straight, $18-28\mu$ long; stalk cell somewhat cuneate $6-10\mu$ long; head cell ovate to clavate-cylindric, entire, usually broadly rounded at the apex, $12-19 \times 8-11\mu$. Mucronate hyphopodia on few hyphae, mixed with capitulate, opposite or alternate, squat ampulliform, $13-18 \times 6-7\mu$, with short neck 3μ thick. Mycelial setae fairly numerous, scattered and also grouped around the perithecia, erect, straight, simple obtuse black, $200-300 \times 7-8\mu$. Perithecia scattered black globose verrucose, up to 170μ diam. Spores dark brown, cylindric with rounded ends, 4-septate constricted $34-40 \times 13-16\mu$ (average $36.5 \times 14.5\mu$).

✓ 12. **Meliola Castanopsisidis** sp. nov.

FIGURE 12

Plagulae hypophyllae atrae tenues usque ad 20 mm. diam., tenuiter velutinae. Mycelium ex hyphis atrobrunneis flexuosis vel geniculatis, $4.5-6\mu$ crassis, (cellulis plerumque $20-30\mu$ longis) irregulariter ramosis, interdum dichotomis, laxe reticulatis compositum. Hyphopodia capitata alternata vel opposita ($\sim 30\%$), post septum hyphae efformata, plus minusve curvata $12-23\mu$ longa, cellula basali cylindracea curvata $3-9\mu$ longa, cellula apicali cylindracea clavata vel rotundato-3-anguloso, plerumque integra, raro sublobata, saepe fortiter curvata, $8-14 \times 6-10\mu$. Hyphopodia mucronata rara ampullacea alternata $14-18 \times 5-6\mu$ collo curvato 3μ crasso. Setae myceliales tenuiter dispersae et juxta perithecia aggregatae, erectae rectae opae atrae $250-400 \times 7-8\mu$, apice 2-4-dentatae ($\sim 8\mu$), raro breviter 2-furcatae ($\sim 10\mu$) et ramis dentatis. Perithecia dispersa atra globosa verrucosa usque ad 195μ diam. Sporae ellipsoideae vel subfusoidae utrinque rotundatae, curvatae, atrobrunneae, 4-septatae, leniter constrictae, $45-56 \times 16-20\mu$ (av. $50 \times 19\mu$), cellula centrale majore.

Hab. in foliis *Castanopsisidis tibetanae*, Kweichow Province, Ma Tsao Ho, Chiang K'ou Hsien, Fan Ching Shan, 25.10.1931, *Cheo* 758.

Colonies hypophyllous black thin up to 20 mm. diam., thinly velvety. Mycelium of dark brown very crooked hyphae $4.5-6\mu$ thick, the cells

mostly 20–30 μ long, branching irregular, sometimes dichotomous, loosely reticulate. Capitate hyphopodia alternate or opposite, formed behind the septum of the parent cell, more or less bent, 12–23 μ long; stalk cell cylindric, more or less bent, 3–9 μ long; head cell cylindric clavate or rounded-triangular, usually entire, rarely sublobed, often sharply bent 8–14 x 6–10 μ . Mucronate hyphopodia rare, scattered amongst the capitate, ampulliform, alternate 14–18 x 5–6 μ neck bent 3 μ thick. Mycelial setae thinly scattered and also grouped around the perithecia, erect, opaque black, straight 250–400 x 7–8 μ , apex 2–4-dentate to 8 μ or rarely shortly 2-furcate to 10 μ with the branches dentate. Perithecia scattered black globose verrucose, up to 195 μ diam. Spores ellipsoid to subfusoid with rounded ends, dark brown, 4-septate, slightly constricted, 45–56 x 16–20 μ (average 50 x 19 μ), the middle cell considerably the largest.

This occurs mixed with *Irenina Castanopsidis*, from which it differs markedly in mycelial characters, in the presence of setae and in its very characteristic spores. The dichotomous branching of the hyphae and the formation of the capitate hyphopodia behind the septum of the parent cell are very unusual characters in the *Meliola* group of genera.

13. *Meliola Koelreuteriae* sp. nov.

FIGURE 13

Plagulae amphigenae, plerumque epiphyllae, interdum caulicolae, tenues, orbiculares 1–3 mm. diam., saepe numerosae confluentesque. Mycelium ex hyphis atrobrownis subrectis vel sinuosis 6–7 μ crassis (cellulis plerumque 20–25 μ longis) oppositè ramosis (45–90°) laxè reticulatis compositum. Hyphopodia capitata alternata, suberecta, plerumque recta, 11–18 μ longa, cellula basali cylindracea 3–7 μ longa, cellula apicali subglobosa vel ovato-clavata, integra 7–13 x 7–11 μ . Hyphopodia mucronata numerosa dispersa opposita vel alternata anguste ampullacea, plus minusve curvata 16–22 x 6–8 μ , collo elongato 3 μ crasso. Setae myceliales dispersae erectae rectae atrae 200–260 x 7–8 μ , apice 2–5-dentato-cristatae (2–11 μ , interdum 2-furcatae (–10 μ). Perithecia dispersa atra globosa verrucosa usque ad 190 μ diam. Sporae atrobrownae cylindraceae vel subellipsoideae utrinque rotundatae 4-septatae constrictae 35–42 x 14–17 μ (av. 38.5 x 16 μ).

Hab. in foliis *Koelreuteriae* sp., Kwangsi Province, Ta Tseh Shan (Yung Hsien), 19.8.1933, *Cheo* 2522.

Colonies amphigenous, mostly epiphyllous, sometimes also caulicolous, thin orbicular 1–3 mm. diam., often numerous and confluent. Mycelium of substraight to more or less sinuous dark brown hyphae 6–7 μ thick, the cells mostly 20–25 μ long, branching usually opposite at 45–90°, loosely reticulate. Capitate hyphopodia alternate only, at wide angles, usually straight, 11–18 μ long; stalk cell cylindric 3–7 μ long, head cell subglobose to ovate-clavate, entire, 7–13 x 7–11 μ . Mucronate hyphopodia rather numerous, scattered amongst the capitate, opposite or alternate, narrow ampulliform, more or less bent, 16–22 x 6–8 μ , with elongate neck 3 μ thick. Mycelial setae scattered erect straight black 200–260 x 7–8 μ , the apex 2–5-dentate-cristate 2–11 μ , or sometimes 2-furcate to 10 μ and the branches dentate. Perithecia scattered black globose verrucose, up to 190 μ diam. Spores dark brown cylindric to subellipsoid with rounded ends, 4-septate constricted, 35–42 x 14–17 μ (average 38.5 x 16 μ).

14. *Meliola kweichowensis* sp. nov.

FIGURE 14

Plagulae epiphyllae tenues atrae 1-3 mm. diam. vel confluentes. Mycelium ex hyphis atrobrunneis subrectis 4.5-6 μ crassis (cellulis plerumque 20-25 μ longis) opposite ramosis (60-90°) laxe reticulatis compositum. Hyphopodia capitata alternata plus minusve antrorsa, 10-13 μ longa, recta, cellula basali cylindracea 2-5 μ longa, cellula apicali globosa integra 8-10 μ diam. Hyphopodia mucronata dispersa opposita vel alternata, ampullacea, plus minusve curvata 13-18 x 6-8 μ , collo 3 μ crasso. Setae myceliales fere omnino juxta perithecia evolutae, erectae atrae rectae simplices, obtusae vel subacutae, usque ad 280 x 8 μ . Perithecia laxe dispersa atra globosa verrucosa usque ad 140 μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4-septatae constrictae 29-36 x 11-13 μ (av. 33 x 12 μ).

Hab. in foliis *Styracis benzoin*, Kweichow Province, Liang Feng Yah (Taunyi Hsien) 31.7.1931, *Cheo* 180 p.p.

Colonies epiphyllous thin black 1-3 mm. diam. or confluent. Mycelium of substraight dark brown hyphae 4.5-6 μ thick, the cells mostly 20-25 μ long, branching opposite at 60-90°, loosely reticulate. Capitulate hyphopodia alternate, more or less antrorse, 10-13 μ long, straight; stalk cell cylindric 2-5 μ long; the head cell globose entire 8-10 μ diam. Mucronate hyphopodia scattered, opposite or alternate, ampulliform, more or less bent, 13-18 x 6-8 μ , the neck 3 μ thick. Mycelial setae almost entirely grouped around the perithecia, erect black straight simple obtuse to subacute, up to 280 x 8 μ . Perithecia loosely scattered, black globose verrucose, up to 140 μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted, 29-36 x 11-13 μ (average 33 x 12 μ).

15. *Meliola symplocicola* Yamamoto, var. *chinensis* var. nov.

FIGURE 15

Plagulae amphigenae tenues orbiculares usque ad 4 mm. diam. vel confluentes. Mycelium ex hyphis atrobrunneis subrectis vel leniter sinuosis 6-7 μ crassis (cellulis plerumque 25-30 μ longis) opposite ramosis (60-90°) laxe reticulatis compositum. Hyphopodia capitata alternata 18-30 μ longa, recta vel curvata, suberecta, cellula basali cylindracea 4-9 μ longa, recta vel curvata, cellula apicali cylindracea apice rotundata, saepe curvata, interdum subuncinata, 14-22 x 9-11 μ . Hyphopodia mucronata dispersa opposita vel alternata, anguste ampullacea 18-28 x 7-9 μ , collo elongato curvato 3 μ crasso. Setae myceliales juxta perithecia aggregatae et in mycelio laxe dispersae, haud numerosas, erectae rectae atrae simplices acutae 300-560 x 9-10 μ . Perithecia dispersa atra globosa verrucosa usque ad 170 μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae 38-46 x 17-21 μ (av. 42 x 19 μ).

Hab. in foliis *Symploci*, *setchuenensis*, Kweichow Province Huei Hsiang P'ing, Chiang K'ou Hsien, Fan Ching Shan, 2.10.1931, *Cheo* 632.

Colonies amphigenous, thin, orbicular, up to 4 mm. diam. or confluent. Mycelium of substraight to slightly sinuous dark brown hyphae 6-7 μ thick, the cells mostly 25-30 μ long, branching mostly opposite at 60-90°, loosely reticulate. Capitulate hyphopodia alternate 18-30 μ long, straight or bent, at wide angles; stalk cell cylindric 4-9 μ long, straight or bent; head cell cylindric with entire rounded apex, often more or less bent, sometimes uncinata, 14-22 x 9-11 μ . Mucronate hyphopodia scattered amongst the capitulate, opposite or alternate, narrow ampulliform 18-28 x 7-9 μ , neck elongate, bent or contorted, 3 μ thick. Mycelial setae grouped around

the perithecia and thinly scattered over the mycelium, not numerous, erect straight simple acute $300\text{--}560 \times 9\text{--}10\mu$. Perithecia scattered black globose slightly verrucose, up to 170μ diam. Spores dark brown cylindric with rounded ends, 4-septate constricted $38\text{--}46 \times 17\text{--}21\mu$, (average $42 \times 19\mu$).

16. *Asterina Brandisiae* sp. nov.

FIGURE 16

Plagulae epiphyllae usque ad 1 mm. diam., aegre perspicues atrae tenues leves, interdum confluentes. Mycelium ex hyphis atrobrunneis $4\text{--}5\mu$ crassis (cellulis circa 20μ longis) laxe reticulatis, primariis subrectis, aliis undulatis vel flexuosis, laxe reticulatis compositum. Hyphopodia continua, alternata vel unilateralia, $5\text{--}8\mu$ longa, $6\text{--}11\mu$ crassa, 3-6-lobata, symmetricalia vel irregularia. Thyriothecia numerosa dense aggregata rotundata $100\text{--}160\mu$ diam., saepe 2-plures-connata, atra; paries inferior hyalinus indistinctus; paries superior virideo-niger, ex hyphis radiantibus $5\text{--}7\mu$ crassis, cellulis $5\text{--}10\mu$ longis, compositus, margine haud fimbriatus, stellatim dehiscens. Asci paraphysati numerosi globosi vel saccati, sessiles apice late rotundati, haud incrassati, 8-sporei, $32\text{--}40 \times 20\text{--}25\mu$. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, 1-septatae constrictae $18\text{--}22 \times 10\text{--}11\mu$, cellulis subaequalibus subglobosis, episporio subtiliter granuloso-verruculoso. Pycnidia numerosa, thyriotheciis consimilia; pycnosporeae subglobosae ellipsoideae vel piriformes, continuae $14\text{--}17 \times 8\text{--}12\mu$, atrobrunneae, in medio zono subhyalino praeditae, leves.

Hab. in foliis *Brandisiae* sp., Kwangsi Province, Loh Hoh Tsuan, Ling Yuin Hsien, *Cheo* 1824.

Colonies epiphyllous, up to 1 mm. diam., inconspicuous black thin smooth, sometimes confluent. Mycelium of loosely reticulate dark brown hyphae $4\text{--}5\mu$ thick, the cells mostly about 20μ long, the primary hyphae more or less straight, the others undulate to crooked; the mycelium becoming closely reticulate in the centre when the perithecia are developing; branching opposite or irregular. Hyphopodia continuous, alternate or unilateral, $5\text{--}8\mu$ long, $6\text{--}11\mu$ broad, 3-6-lobed with rather deep lobes, symmetrical or irregular. Thyriothecia numerous, closely crowded, $100\text{--}160\mu$ diam., more or less circular, often 2-several-connate into large irregular compound ascomata, black to greenish black. Upper wall opaque green-black, composed of a single layer of radiating hyphae $5\text{--}7\mu$ thick, the cells $5\text{--}10\mu$ long, the margin crenate, not fimbriate; dehiscent by numerous stellate fissures extending to the margin, into narrowly triangular segments. Lower wall of thyriothecium hyaline, indistinct. Asci numerous, paraphysate, globose to ellipsoid, sessile, broadly rounded at the apex, thin-walled, 8-spored $32\text{--}40 \times 20\text{--}25\mu$. Spores conglobate dark brown, oblong with rounded ends, 1-septate, constricted $18\text{--}22 \times 10\text{--}11\mu$, the cells more or less equal and subglobose; episporio finely granular-verruculose. Pycnidia numerous, scattered amongst the thyriothecia and closely resembling these, $80\text{--}110\mu$ diam.; pycnospores subglobose, ellipsoid or piriform, continuous, $14\text{--}17 \times 8\text{--}12\mu$, dark brown with subhyaline central transverse zone, smooth.

17. *Asterina Jasmini* sp. nov.

FIGURE 17

Plagulae epiphyllae atrae leves densa orbiculars usque ad 4 mm. diam., numerosae confluentes. Mycelium ex hyphis atrobrunneis flexuosis $4\text{--}5\mu$ crassis, (cellulis

plerumque 15–20 μ longis, irregulariter ramosis, dense reticulatis compositum. Hyphopodia alternata vel unilateralia, continua, subglobosa vel 3–5-lobata, 7–11 x 8–12 μ . Thyriothechia dense dispersa, plerumque discreta, rotundata atra 100–160 μ diam.; paries inferior ex hyphis laxe radiantibus virideo-hyalinis 4–5 μ crassis compositus; paries superior convexus, opace atrobrunneus, ex hyphis radiantibus 4–5 μ crassis, cellulis 5–10 μ longis compositus, margine fimbriatus, hyphis fimbriarum tortuoso-radiantibus brunneis exhyphopodiatis usque ad 70 μ longis, stellatim prope marginem dehiscens, partibus centralibus secedentibus. Asci numerosi, in ordine maturescentes, globosi aparaphysati sessiles tenuiter tunicati, 40–45 μ diam. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, 1-septatae fortiter constrictae, 26–31 x 14–16 μ , cellulis subaequalibus, episorio subtiliter granuloso.

Hab. in foliis *Jasmini* sp., Kwangsi Province, Loh Hoh Tsuen, Ling Yuin Hsien, 30.3.1933, *Cheo* 1756.

Colonies epiphyllous black smooth dense orbicular, up to 4 mm. diam., usually very numerous and confluent over the leaf. Mycelium of dark brown crooked hyphae 4–5 μ thick, the cells mostly 15–20 μ long, branching irregular, closely reticulate-interwoven. Hyphopodia continuous, alternate or unilateral, (many hyphae exhyphopodiate) subglobose to palmately 3–5-lobed, 7–11 x 8–12 μ . Thyriothechia closely scattered, usually discrete, circular black 100–160 μ diam.; basal wall of loosely radiating greenish hyaline hyphae 3 μ thick; the upper wall convex, of opaque dark brown radiating hyphae 4–5 μ thick, the cells 5–10 μ long; margin fimbriate, the fringing hyphae tortuous radiating, paler than the mycelium, exhyphopodiate, up to 70 μ long; dehiscence by stellate fissures almost to the margin, the central parts falling away and exposing the layer of asci. Asci aparaphysate numerous, ripening in succession, globose, sessile, thin-walled, 40–45 μ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, deeply constricted, the surface finely granulose, 26–31 x 14–16 μ . Pycnidia and pycnospores not seen.

18. *Asterina Linderæ* sp. nov.

FIGURE 18

Plagulae epiphyllae atrae orbiculares usque ad 4 mm. diam., leves, subdensae. Mycelium ex hyphis atrobrunneis 3–4.5 μ crassis, cellulis plerumque 20–25 μ longis, oppositae vel irregulariter ramosis, dense reticulatis compositum, hyphis primariis subrectis, ramis undulatis vel flexuosis et saepe exhyphopodiatis. Hyphopodia alternata, digitato-cylindracea apice rotundata, integra 8–12 x 5–6 μ , continua. Thyriothechia dense dispersa, rotundata 100–170 μ diam., atra saepe 2–3-connata; paries inferior ex hyphis hyalinis tortuoso-radiantibus 3–4 μ crassis compositus; paries superior atrobrunneus, convexus, ex hyphis subopace brunneis radiantibus 4–5 μ crassis, cellulis 4–10 μ longis compositus, margine fimbriatus, hyphis fimbriarum tortuoso-radiantibus, usque ad 40 μ longis, saepe laterale connatis, stellatim prope marginem dehiscens, partibus centralibus secedentibus. Asci numerosi, in ordine maturescentes, ovati vel globosi, sessiles, tenuiter tunicatae, aparaphysati, 25–30 x 20–25 μ , 4–8-spori. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, 1-septatae constrictae 18–22 x 8–9 μ , cellulis subaequalibus, episorio levi.

Hab. in foliis *Linderæ* sp., Kweichow Province, Lai Ling, Chiang K'ou Hsien, Fan Ching Shan, 17.9.1931, *Cheo* 519.

Colonies epiphyllous black orbicular, up to 4 mm. diam., smooth rather dense. Mycelium of dark brown hyphae 3–4.5 μ thick, the cells mostly 20–25 μ long, branching opposite or irregular, closely reticulate; primary

hyphae substraight, the others undulate to crooked and often without hyphopodia. Hyphopodia alternate, digitate-cylindric with entire rounded apex, continuous, 8–12 x 5–6 μ . Thyriothecia closely scattered, circular 100–170 μ diam., black, often 2–3-connate into irregular compound ascomata; basal wall of hyaline tortuous-radiating hyphae 3–4 μ thick; upper wall of dark brown subopaque radiating hyphae 4–5 μ thick, the cells 4–10 μ long, margin fimbriate, the fringing hyphae tortuous-radiating, up to 40 μ long, more or less laterally connate into irregular sheets; dehiscence by few radiate fissures to the margin into broadly triangular segments, the central parts falling away and the remainder of the upper wall becoming more or less erect around the exposed layer of asci. Asci numerous, ripening in succession, ovate to globose, sessile, thin-walled, paraphysate 25–30 x 20–25 μ , 4–8-spored. Spores conglobate, dark brown, oblong with rounded ends, 1-septate constricted, 18–22 x 8–9 μ , the cells equal; surface smooth.

19. **Eriomycopsis chinensis** sp. nov.

Mycelium ex hyphis hyalinis dense reticulatis circa hyphas *Asterinae*, 2–3 μ crassis, septatis, irregulariter ramosis. Conidiophora erecta, dispersa vel 2–3-fasciculata deorsum brunnea, superne pallidiora vel hyalina, subrecta vel superne leniter geniculata, 2–3-septata, simplices, 100–150 x 4–5 μ , prope apicem sterigmata hyalina recta cylindracea 6–7 x 1 μ praedita. Conidia singula elongato-fusoida hyalina recta vel curvula 2–3-septata haud constricta levia 29–42 x 4–5 μ , apice acute rotundata, basi truncata, hilo plano 1 μ diam. et 1 μ cr. praedita.

Hab. in mycelio *Asterinae Linderae*, in foliis *Linderae* sp., Kweichow Province, Lao Ling, Chiang K'ou Hsien, Fan Ching Shan, 17.9.1931, *Cheo* 519 p.p.

Mycelium hyaline closely reticulate over and between the hyphae of the *Asterina* host, the hyphae 2–3 μ thick, irregularly branched, septate. Conidiophores scattered or 2–3-aggregate, dark brown in lower part, paler to subhyaline near the apex, erect, more or less straight below, bent and sometimes somewhat geniculate in upper part, 2–3-septate, simple, 100–150 x 4–5 μ . The two distal cells bear 2–8 closely and irregularly scattered sterigmata, hyaline straight cylindric, apparently hollow, 6–7 x 1 μ ; sometimes one or two similar sterigmata occur lower down. Conidia formed singly on the ends of the sterigmata, hyaline, elongate straight or bent fusoid, smooth, thin-walled, 2–3-septate, not constricted, 29–42 x 4–5 μ ; apex acutely rounded, base 1 μ thick and truncate.

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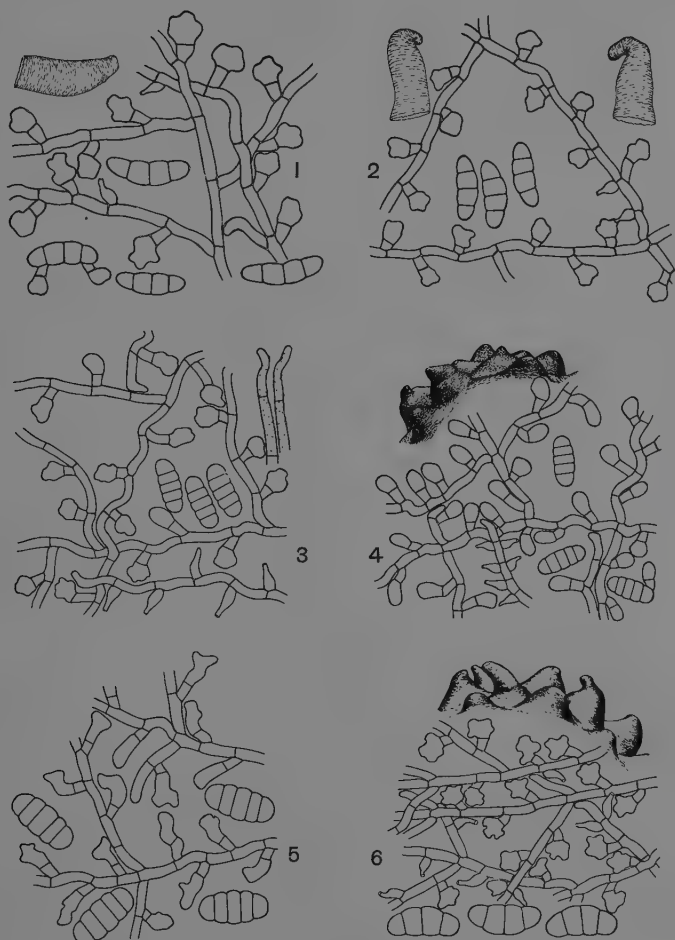


Fig. 1-6. All outlines $\times 250$. 1, *Irene calostroma*. 2, *Irene styracicola* var. *minor*.
 3, *Irenopsis benguetensis*. 4, *Irenina Buddleiae*. 5, *I. Castanopsidis*. 6, *I. Cheoi*.

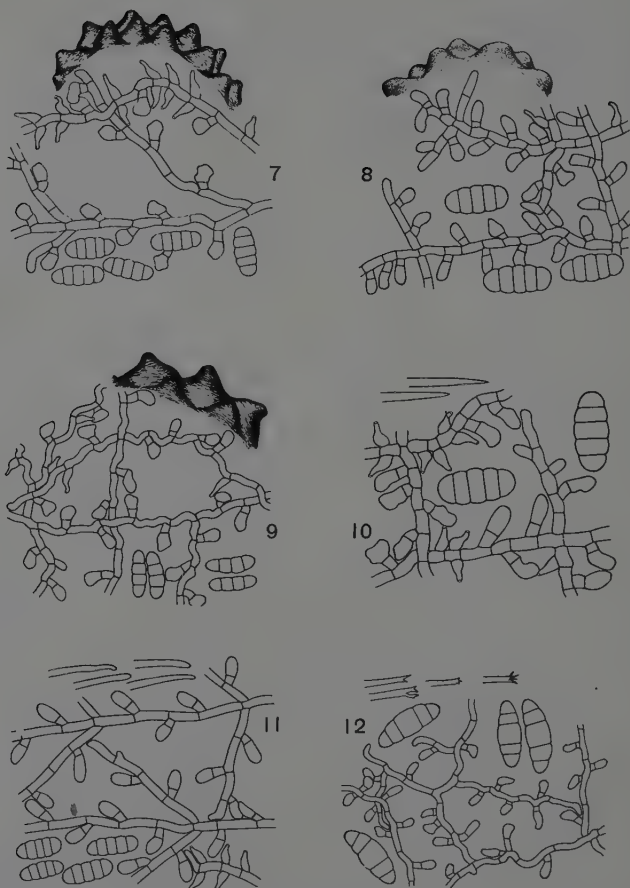


Fig. 7-12. All outlines $\times 250$. 7, *Irenina Lonicerae*. 8, *I. quercina*. 9, *I. Rosae*. 10, *Meliola Actinodaphnes*. 11, *M. Brandisiae*. 12, *M. Castanopsidis*.

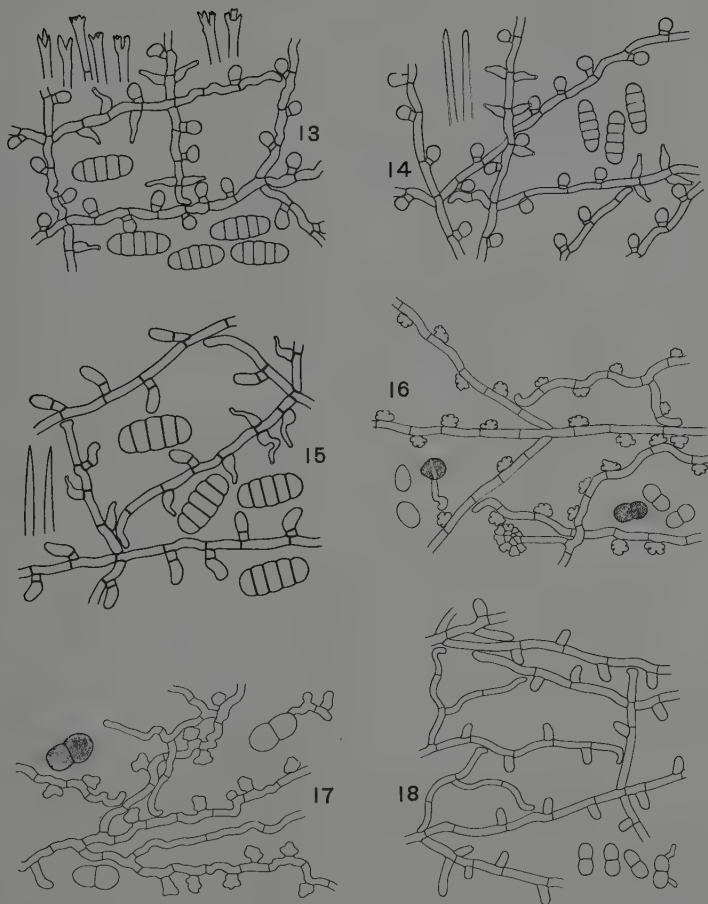


Fig. 13-18. All $\times 250$. 13, *Meliola Koelreuteriae*. 14, *M. kweichowensis*. 15, *M. symplocicola* var. *chinensis*. 16, *Asterina Brandisiae*. 17, *A. Jasmini*. 18, *A. Linderae*.

FUNGI OF SOUTH INDIA

BY

C. G. HANSFORD AND M. J. THIRUMALACHAR

The fungi enumerated below have been collected during recent years in various parts of South India by the junior author and in most instances represent either new species or new records for India.

1. *Dictyonella Alangii* sp. nov.

FIGURE 1

Coloniae hypophyllae effusae tenues brunneae. Mycelium ex hyphis brunneis rectis septatis $3-4\mu$ crassis exhyphopodiatis irregulariter ramosis laxe reticulatis compositum. Ascomata laxe dispersa, primo obconica, demum discoidea, usque ad 400μ diam. et circa 100μ alt., superficialia rufo-brunnea vel atro-brunnea, hyphis ferrugineis intertextis $2-5\mu$ crassis vestita. Asci numerosi aparaphysati, laxe unistratosi, subglobosi nodoso-stipitati, $30-40 \times 25-30\mu$, 8-spore, crasse tunicati ($1-1.5\mu$). Sporae multiseriatae vel fere conglobatae, oblongae utrinque rotundatae, atrobrunneae leves transverse 5-septatae, in medio leniter constrictae, parte superiore leniter crassiore, cellulis pluribus longitudinaliter 1-septatis, $19-24 \times 9-11\mu$. Conidiophora laxe dispersa, erecta atrobrunnea recta septata, usque ad $120 \times 5\mu$, apice dense furcata, ramulis et conidiis capitulum globosum efformantibus. Conidia globosa brunnea levia continua 2μ diam., an catenulata ?.

Hab. in foliis *Alangii begoniifolii*, Thirthahalli, Mysore, 3.4.1945, *Thirumalachar* 881.

The colonies are always hypophyllous, widely effuse over the leaf, thin and brownish. The mycelium consists of straight brown septate hyphae $3-4\mu$ thick, exhyphopodiate, irregularly and loosely branched, forming dark mycelial knots at the apices of the unicellular leaf hairs, on which the fungus appears to be parasitic. There is also a fine, much branched, hyaline mycelium within the mesophyll, and emergent through a few stomata, but definite connection between this and the external hyphae could not be established, though both kinds of hyphae ramify amongst the leaf hairs. The ascomata are entirely superficial on the external mycelium, and easily detached from the host leaf; at first obconic and clothed with a layer of ferruginous interwoven loose hyphae $2-5\mu$ thick and septate into short cells, with the terminal cells somewhat swollen and subglobose. Towards the base of the ascoma this external hyphal layer is more compact and pseudoparenchymatous, with the hyphae of the mycelium radiating outwards from it. The ascomata as they mature become flattened discoid, up to 400μ diam. and about 10μ high, covered around the edge with the remains of the original ferruginous hyphae, with the centre darker and almost black when the spores have matured. The asci are in a loose single layer, and apparently separated by remains of the stroma tissue, without true paraphyses, numerous, globose with a very short nodose foot, thick-walled ($1-1.5\mu$) 8-spored, $30-40 \times 25-30\mu$. Spores almost con-

globose, oblong with rounded ends, subopaque dark brown, transversely 5-septate and with the larger cells longitudinally 1-septate, slightly constricted at the middle septum and with the upper half slightly wider than the lower; whole spores $19-24 \times 9-11\mu$.

The conidiophores are of *Periconia* type, loosely scattered over the mycelium, each arising from a swollen foot cell which is usually lateral on the parent hypha, erect, dark brown, straight, septate, up to $120 \times 5\mu$, the apex divided into a number of very short close branches, which together with the conidia form a small terminal globose head. Conidia possibly catenulate from the tips of the branches of the conidiophore, globose, brown, continuous, smooth, 2μ diam.

Though this fungus lacks the typically more or less spongy-glebose structure of Myriangiaceae, it does not possess a true parenchymatous wall around the ascoma, nor is a definite ostiole present; the spores are of a type very common in this family.

2. **Armatella Litseae** (P. Henn.) Theiss. & Sydow in Ann. Mycol. 13: 235.1915.

FIGURE 2

On *Neolitsea zeylanica*, Nandi, Mysore, *Thirumalachar* 901 p.p.

Colonies epiphyllous black rounded, usually discrete, thin to sub-dense, up to 8 mm. diam. Mycelium of straight to finely wavy dark brown hyphae $5-7\mu$ thick, the cells mostly $15-30\mu$ long, branching regularly alternate, rather closely reticulate. Capitate hyphopodia alternate only, at wide angles, $15-22\mu$ long, stalk cell short cylindric $2-5\mu$ long, head cell irregularly stellate with numerous lobes, $8-15 \times 10-15\mu$. Mucronate hyphopodia none. Mycelial setae none. Perithecia loosely scattered, black, globose, up to 180μ diam., the surface cells bluntly conoid or rounded, somewhat projecting. Spores oblong with rounded ends, 1-septate constricted smooth $37-42 \times 12-15\mu$; at germination the upper cell much darker than the lower, which finally collapses while a hyphopodium is formed by an apical outgrowth. Each perithecium is surrounded by a fringe of tortuous-radiating pale brown exhyphopodiate hyphae up to 100μ long.

3. **Armatella Cinnamomi** sp. nov.

FIGURE 3

Plagulae hypophyllae tenues effusae irregulares atrae confluentes. Mycelium ex hyphis atrobrunneis sinuosis vel undulatis, $4-5\mu$ crassis (cellulis plerumque $20-30\mu$ longis) irregulariter ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata vel unilateralia $10-20\mu$ longa, cellula basali cylindracea $2-6\mu$ longa, cellula apicali globosa, cylindracea vel uncinata, interdum sub-2-lobata, $6-15 \times 5-10\mu$. Hyphopodia mucronata nulla. Setae nullae. Perithecia laxe dispersa, discreta atra globosa verrucosa, usque ad 140μ diam., cellulis parietis obtuse conoideis prominentibus. Asci non visi. Sporae oblongae utrinque rotundatae, dilute brunneae, 1-septatae, constrictae leves $20-22 \times 9-11\mu$, cellula superiore leniter crassiore.

Hab. in foliis *Cinnamomi zeylanici*, Balehonnur, Mysore, 27.4.1945, *Thirumalachar* 886.

Colonies hypophyllous thin, effuse and covering most of the leaf, confluent, irregular, black. Mycelium of dark brown crooked to undulate hyphae $4-5\mu$ thick, the cells $20-30\mu$ long, branching irregular, loosely

reticulate. Capitate hyphopodia alternate or unilateral, usually one to each cell, formed some distance behind the septum of the parent cell, 10–20 μ long; stalk cell cylindric 2–6 μ long; head cell globose, cylindric or boot-shaped, sometimes sub-2-lobate, 6–15 x 5–10 μ . Mucronate hyphopodia none. Setae none. Perithecia loosely scattered single black globose verrucose, up to 140 μ diam., the surface cells bluntly conic, projecting; wall not radiate but truly parenchymatous; each perithecium surrounded at the base with an areole of radiating hyphopodiate hyphae and easily detached from the leaf, leaving this areole and hence closely resembling an *Asterina*. Asci not seen. Spores oblong with rounded ends, pale brown 1-septate constricted smooth, 20–22 x 9–11 μ , the upper cell slightly larger than the lower. At germination the upper cell becomes darker brown, while the lower cell collapses; from the upper a hyphopodium grows out.

4. *Amazonia Leeae* sp. nov.

FIGURE 4

Plagulae amphigenae plerumque epiphyllae, dispersae atrae orbiculares leves densae, tenuiter crustosae, usque ad 1 mm. diam. Mycelium ex hyphis atrobrunneis undulatis 7–9 μ crassis (cellulis plerumque 10–15 μ longis) alternatim vel irregulariter ramosis, densissime reticulatis compositum. Hyphopodia capitata alternata antrorsa subrecta 12–16 μ longa, cellula basali cylindracea 3–5 μ longa, cellula apicali globosa integra 10–12 μ diam. Hyphopodia mucronata non visa. Setae nullae. Perithecia depressoglobosa atra, usque ad 260 μ diam., sursum hyphis mycelii rad'antibus vestita, irregulariter dehiscentia. Sporae atrobrunneae subellipsoideae utrinque rotundatae, 4-septatae constrictae 39–45 x 17–21 μ .

Hab. in foliis *Leeae macrophyllae*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar* 867.

Colonies mostly epiphyllous, scattered, black, orbicular smooth dense, thinly crustose, up to 1 mm. diam. Mycelium of radiating dark brown undulating hyphae 7–9 μ thick, the cells mostly 10–15 μ long, branching alternate or unilateral, forming almost a solid plate of hyphae and hyphopodia. Capitate hyphopodia alternate, antrorse, usually straight, 12–16 μ long; head cell globose, entire, 10–12 μ diam.; stalk cell cylindric 3–5 μ long. Mucronate hyphopodia not seen; setae none. Perithecia flattened globose with a radiate upper wall of mycelial hyphae, up to 260 μ diam., black, opaque, irregularly dehiscent in the centre. Spores dark brown, ellipsoid with rounded ends, 4-septate, constricted, 39–45 x 17–21 μ .

5. *Irenopsis mysorensis* sp. nov.

FIGURE 5

Plagulae epiphyllae, raro etiam hypophyllae, atrae orbiculares densae numerosae, dense dispersae, usque ad 1 mm. diam. Mycelium ex hyphis atrobrunneis subrectis vel undulatis, 6–7 μ crassis (cellulis plerumque 20–25 μ longis) opposita ramosis (45–90°) dense reticulatis compositum. Hyphopodia capitata alternata, plerumque recta, 15–22 μ longa, cellula basali cylindracea 4–9 μ longa, cellula apicali globosa vel late clavata, integra vel raro subangulosa, 10–15 x 10–14 μ . Hyphopodia mucronata pauca, dispersa, opposita vel alternata, ampullacea vel obtuse conoidea, plus minusve curvata, 15–21 x 6–8 μ , collo 3–4 μ crasso. Setae myceliales nullae. Perithecia in centro plagularum aggregata, atra globosa verrucosa 150–210 μ diam., cellulis parietis obtuse

conoideis; setae perithecales 0-5, erecto-divergentes, atrobrunneae simplices obtusae leves 0-1-septatae, irregulariter curvatae, haud hamatae, usque ad $60 \times 6-7\mu$. Sporae atrobrunneae cylindratae vel subellipsoideae utrinque rotundatae, 4-septatae constrictae $38-45 \times 14-18\mu$.

Hab. in foliis *Lasiosiphonis ericocephali*, Ranjadakatte, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar* 873.

Colonies epiphyllous, rarely hypophyllous, black orbicular dense smooth numerous, closely scattered, up to 1 mm. diam. Mycelium of substraight to undulate dark brown hyphae $6-7\mu$ thick, the cells mostly $20-25\mu$ long, branching usually opposite at $45-90^\circ$, closely reticulate. Capitulate hyphopodia alternate, usually straight, $15-22\mu$ long; head cell globose to widely clavate, entire or rarely subangulose, $10-15 \times 10-14\mu$; stalk cell cylindric $4-9\mu$ long. Mucronate hyphopodia few, scattered, opposite, alternate or solitary, ampulliform to blunt conoid, bent, $15-21 \times 6-8\mu$, neck $3-4\mu$ thick. Mycelial setae none. Perithecia in a close central group, black, globose, verrucose, $150-210\mu$ diam., the surface cells bluntly conoid; perithecial setae 0-5 erect-divergent, dark brown, simple, obtuse, irregularly bent but not hamate or coiled, smooth, up to 60μ long by $6-7\mu$ thick, 0-1-septate, arising from the sides and upper half of the perithecial wall. Spores cylindric to subellipsoid with rounded ends, dark brown 4-septate, constricted, $38-45 \times 14-18\mu$ (average $42 \times 16\mu$).

6. *Irenina Pothodis* sp. nov.

FIGURE 6

Plagulae amphigenae plerumque epiphyllae, usque ad 2 mm. diam., leves orbiculares atrae densae, dense dispersae. Mycelium ex hyphis subrectis vel sinuosis atrobrunneis $8-9\mu$ crassis (cellulis plerumque $25-30\mu$ longis) opposita ramosis ($45-90^\circ$) dense reticulatis compositum. Hyphopodia capitata alternata antrorsa recta vel curvata, $15-25\mu$ longa, cellula basali cylindrata vel cuneata $4-10\mu$ longa, cellula apicali globosa ovata clavata vel angulosa, recta vel curvula, $10-14 \times 8-10\mu$. Hyphopodia mucronata pauca dispersa, opposita vel alternata, ampullacea $13-20 \times 8-10\mu$, collo brevi $3-4\mu$ crasso. Setae myceliales nullae. Perithecia dense dispersa, atra globosa usque ad 190μ diam., cellulis parietis obtuse conoideis aegre prominentibus. Sporae atrobrunneae, cylindratae vel subellipsoideae utrinque rotundatae, 4-septatae constrictae $38-46 \times 15-18\mu$.

Hab. in foliis *Pothodis scandentis*, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar* 879.

Colonies amphigenous, mostly epiphyllous, up to 2 mm. diam., smooth, orbicular, black, subdense, closely scattered. Mycelium of substraight to crooked dark brown hyphae $8-9\mu$ thick, the cells mostly $25-30\mu$ long, branching usually opposite at $45-90^\circ$, closely reticulate. Capitulate hyphopodia alternate, antrorse, straight or bent, $15-25\mu$ long; head cell globose, ovate, clavate or angulose, straight or bent, $10-14 \times 10-13\mu$; stalk cell $4-10\mu$ long. Mucronate hyphopodia few, scattered, opposite or alternate ampulliform, $13-20 \times 8-10\mu$ neck short $3-4\mu$ thick. Mycelial setae none. Perithecia closely scattered, black, globose, up to 190μ diam., the surface cells bluntly conoid, scarcely projecting. Spores dark brown, cylindric to subellipsoid with rounded ends, 4-septate, constricted, $38-46 \times 15-18\mu$ (average $43 \times 16.5\mu$).

7. *Irenina Malloti* sp. nov.

FIGURE 7

Plagulae hypophyllae, in tomento folii absconditae, usque ad 4 mm. diam., vel confluentes. Mycelium ex hyphis atrobrunneis sinuosis 6–7 μ crassis (cellulis plerumque 20–35 μ longis) irregulariter ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata recta vel curvata, 14–29 μ longa, cellula basali cylindracea 5–10 μ longa, cellula apicali clavata vel irregulariter rotundato-angulosa raro sublobata 10–20 x 11–16 μ . Hyphopodia mucronata dispersa, alternata vel unilateralia, curvata, conoidea vel ampullacea 17–22 x 7–10 μ , collo 4–5 μ crasso. Perithecia dispersa atra globosa 150–210 μ diam., cellulis parietis mammillatibus usque ad 35 μ alt. Sporae subellipsoideae utrinque rotundatae atrobrunneae 4-septatae constrictae 49–57 x 19–24 μ .

Hab. in foliis *Malloti albae*, Balehonnur, Mysore, 28.9.1944, *Thirumalachar*.

Colonies hypophyllous, hidden amongst the dense tomentum of the leaf with only the perithecia showing, up to 4 mm. diam., or more or less confluent. Mycelium of crooked dark brown hyphae 6–7 μ thick, the cells mostly 20–35 μ long, irregularly branched, loosely reticulate and interwoven amongst the leafhairs. Capitulate hyphopodia alternate only, at wide angles, straight or bent, 14–29 μ long; stalk cell cylindric 5–10 μ long; head cell clavate or irregularly rounded-angulose, occasionally sublobate, 10–20 x 11–16 μ . Mucronate hyphopodia scattered, alternate or unilateral, bent conoid-ampulliform with rather wide neck (4–5 μ), 17–22 x 7–10 μ , occasionally also opposite. Perithecia closely scattered, black, globose, 150–210 μ diam., the surface cells mammillate with bent conoid obtuse processes up to 35 μ high, about 40 μ diam. at the base, often simulating the "larviform appendages" of *Irene* spp., but distinguished in being opaque dark brown and never septate. Spores subellipsoid with rounded ends, dark brown, 4-septate, constricted 49–57 x 19–24 μ (average 53.3 x 21.3 μ).

8. *Meliola Bakeri* Syd. in Ann. Mycol. 14: 355. 1916.

FIGURE 8

On *Leea* sp., Kudumallige, Thirthahalli, Mysore, 3.4.1945, *Thirumalachar* 857; on *L. macrophylla*, Balehonnur, Mysore, *Thirumalachar* 867.

Colonies amphigenous, mostly epiphyllous, black, orbicular to irregular, up to 5 mm. diam. or confluent over the leaf, thin to subdense, velvety. Mycelium of crooked to undulate dark brown hyphae 6–8 μ thick, the cells mostly 20–25 μ long, branching opposite at 45–90°, closely reticulate in some colonies and on *No.* 867, thinner on *No.* 857. Capitulate hyphopodia alternate or 1–5% opposite, straight or bent, 13–25 μ long; head cell cylindric-clavate to angulose or sometimes irregularly 2–3-sublobed, 10–17 x 9–14 μ ; stalk cell cylindric 5–10 μ long. Mucronate hyphopodia on separate branches of the mycelium, few, usually opposite, bent ampulliform, 16–20 x 6–8 μ , with rather long neck 2–3 μ thick. Mycelial setae numerous, scattered, erect, straight, simple, acute to subacute, 260–400 x 7–10 μ . Perithecia scattered, black, globose, verrucose, 120–150 μ . Spores dark brown, cylindric with rounded ends, 4-septate, slightly constricted, 33–42 x 12–15 μ (average 37 x 14 μ).

This is very close to Philippine collections on *Tetrastigma*, the type host, according to collections in Herb. Pretoria.

9. *Meliola bangalorensis* sp. nov.

FIGURE 9

Plagulae amphigenae densae atrae velutinae orbiculares, usque ad 5 mm. diam., in epiphyllis saepe numerosae et late confluentes. Mycelium ex hyphis atrobrunneis sinuosis vel subrectis $7-9\mu$ crassis (cellulis plerumque $15-40\mu$ longis) oppositè ramosis ($45-90^\circ$) dense reticulatis compositum. Hyphopodia capitata alternata (rarissime etiam opposita) recta vel curvata, leniter antrorsa, $15-23\mu$ longa, cellula basali cylindracea $4-9\mu$ longa, cellula apicali subglobosa vel clavata, recta vel curvata, integra vel irregulariter angulosa (in hypophyllo saepe sub-2-3-lobata) $10-16 \times 10-15\mu$. Hyphopodia mucronata modice numerosa, in hyphis distinctis evoluta, opposita, alternata, solitaria vel ternata, ampullacea $15-20 \times 7-9\mu$, plus minusve curvata, collo $2-2.5\mu$ crasso. Setae myceliales numerosae erectae rectae simplices acutae opacae $200-260 \times 8-10\mu$, dense dispersae etiam circum perithecia aggregatae. Perithecia dense dispersa atra globosa verrucosa, usque ad 160μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae $33-40 \times 13-15\mu$.

Hab. in foliis *Fici* sp., Bannerguatta, Bangalore, Mysore, 14.8.1945, *Thirumalachar* 884.

Colonies amphigenous, dense, black, velvety, orbicular to 5 mm. diam., or on the upper side of the leaf often numerous and widely confluent. Mycelium of substraight to crooked dark brown hyphae $7-9\mu$ thick, the cells $15-40\mu$ long, branching opposite at $45-90^\circ$, closely reticulate (the hyphae more crooked in hypophyllous colonies). Capitulate hyphopodia alternate, very rarely opposite, straight or bent, usually at wide angles $15-23\mu$ long; head cell subglobose to clavate, straight or bent, entire or especially in the hypophyllous colonies often irregularly angulose to sub-2-3-lobed, $10-16 \times 10-15\mu$; stalk cell $4-9\mu$ long. Mucronate hyphopodia fairly numerous, on separate hyphae, opposite, alternate, solitary or ternate, ampulliform, $15-20 \times 7-9\mu$, more or less bent; the neck $2-2.5\mu$ thick. Mycelial setae numerous, thickly scattered over the mycelium and also grouped around the perithecia, erect straight simple acute, opaque black, $200-260 \times 8-10\mu$. Perithecia closely scattered, black globose verrucose, up to 160μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted $33-40 \times 13-15\mu$ (average $36 \times 14\mu$).

10. *Meliola Cansjeriae* sp. nov.

FIGURE 10

Plagulae amphigenae orbiculares atrae velutinae subcrustosae usque ad 3 mm. diam., vel numerosae confluentesque. Mycelium ex hyphis atrobrunneis subrectis $7-8\mu$ crassis (cellulis plerumque $15-30\mu$ longis) oppositè ramosis ($30-60^\circ$) dense reticulatis, compositum, in centro plagularum subsolidum. Hyphopodia capitata alternata vel usque ad 15 % opposita, antrorse curvata, $13-25\mu$ longa, cellula basali cylindracea $3-8\mu$ longa, cellula apicali ovata clavata vel cylindracea, integra, apice rotundata, recta vel curvata, $10-17 \times 8-11\mu$. Hyphopodia mucronata pauca dispersa, opposita vel alternata, ampullacea $20-25 \times 7-9\mu$, collo curvato $3-4\mu$ crasso. Setae myceliales numerosissimae erectae rigidae rectae atrae opacae $200-280 \times 9-10\mu$, apice raro simplices acutae, plerumque 2-3-dentatae vel furcatae (-30μ) ramulis dentatis. Perithecia in centro plagularum aggregata, atra globosa verruculosa, usque ad 195μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae $39-47 \times 15-18\mu$.

Hab. in foliis *Cansjeriae Rheedii*, Nandi Hills, Mysore, 25.3.1945, *Thirumalachar*.

Colonies amphigenous orbicular dense black velvety subcrustose, up to

3 mm. diam., or numerous and subconfluent. Mycelium of substraight dark brown hyphae $7-8\mu$ thick, the cells mostly $15-30\mu$ long, branching opposite at $30-60^\circ$, densely reticulate and becoming almost solid in the centre of each colony. Capitate hyphopodia alternate or up to 15% opposite, antrorse bent, $13-25\mu$ long; head cell ovate, clavate or cylindric, entire, rounded at the apex, straight or bent, $10-17 \times 8-11\mu$; stalk cell cylindric $3-8\mu$ long. Mucronate hyphopodia rather few, scattered amongst the capitate, opposite or alternate, ampulliform $20-25 \times 7 \times 9\mu$, neck more or less bent, $3-4\mu$ thick. Mycelial setae very numerous, closely scattered, erect, stiff, straight, black, opaque $200-280 \times 9-10\mu$, apex rarely simple and acute, mostly 2-3-dentate or furcate to 30μ , the branches denticulate. Perithecia in a central group, black, globose verruculose, up to 195μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted $39-47 \times 15-18\mu$ (average $43 \times 16\mu$).

This species is rather close to *M. Opiliae* Syd. but differs in its large proportion of alternate capitate hyphopodia.

11. *Meliola cissampelicola* sp. nov.

FIGURE 11

Plagulae amphigenae plerumque epiphyllae, atrae, orbiculares vel irregulares, saepe numerosae confluentesque, usque ad 1 mm. diam. Mycelium ex hyphis atrobrunneis undulatis $6-8\mu$ crassis (cellulis plerumque $20-35\mu$ longis) opposita vel irregulariter ramosis ($45-90^\circ$) laxe reticulatis compositum. Hyphopodia capitata alternata plus minusve antrorsa, recta vel curvata $20-30\mu$ longa, cellula basali cylindracea vel cuneata $4-11\mu$ longa, cellula apicali ovata vel clavata, integra $13-20 \times 9-13\mu$. Hyphopodia mucronata in hyphis distinctis evoluta, opposita vel plerumque alternata vel unilateralia, ampullacea $14-23 \times 6-8\mu$, colo 4μ crasso. Setae myceliales tenuiter dispersae, erectae, plus minusve irregulariter curvatae, haud uncinatae, $220-340 \times 8-9\mu$, simplices obtusae. Perithecia in centro plagularum laxe aggregata, atra globosa verrucosa $130-160\mu$ diam. Sporae atrobrunneae, cylindraceae utrinque rotundatae, 4-septatae, leniter constrictae $34-39 \times 13-16\mu$.

Hab. in foliis *Cissampeli convolvulaceae*, Agumbe, Mysore, 4.4.1945, *Thirumalachar* 865.

Colonies amphigenous, mostly epiphyllous, black, orbicular or irregular, often numerous and more or less confluent over the whole leaf, up to 1 mm. diam., thin. Mycelium of dark brown undulate hyphae $6-8\mu$ thick, the cells mostly $20-35\mu$ long, branching opposite or irregular at $45-90^\circ$, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or bent, $20-30\mu$ long; head cell ovate to clavate, entire, $13-20 \times 9-13\mu$; stalk cell cylindric-cuneate $4-11\mu$ long. Mucronate hyphopodia on separate hyphae, opposite or mostly alternate or unilateral, ampulliform, $14-23 \times 6-8\mu$ the neck 4μ thick. Mycelial setae thinly scattered, erect, more or less irregularly bent but not uncinatae, $220-340 \times 8-9\mu$, simple obtuse. Perithecia in a loose central group, black, globose, verrucose, $130-160\mu$ diam. Spores dark brown, cylindric with rounded ends, 4-septate, slightly constricted, $34-39 \times 13-16\mu$ (average $36 \times 14.5\mu$).

This species differs considerably from African collections on *Menispermaceae*.

12. *Meliola Dichapetali* sp. nov.

FIGURE 12

Plagulae epiphyllae orbiculares densae atrae velutinae, usque ad 3 mm. diam., crustosae. Mycelium ex hyphis subrectis atrobrunneis $6-8\mu$ crassis (cellulis plerumque $10-20\mu$ longis) oppositè ramosis ($45-90^\circ$) compositum, subsolidum. Hyphopodia capitata opposita vel alternata, plus minusve antrorsa $15-20\mu$ longa, cellula basali cylindræa vel cuneata, saepe curvata $2-9\mu$ longa; cellula apicali clavata vel ovata, apice late rotundata integra, recta vel curvata $10-14 \times 8-12\mu$. Hyphopodia mucronata haud numerosa, dispersa, opposita vel alternata, conoidea vel ampullacea, plus minusve curvata $13-20 \times 7-9\mu$, collo 3μ crasso. Setae myceliales numerosissimae, erectae atrae opacae rectae $200-280 \times 9-11\mu$, apice 2-3-dentatae ($\sim 20\mu$) dentibus late divergentibus. Perithecia in centro plagulatum laxè aggregata, atra globosa, fere levia $120-175\mu$ diam. Sporae atrobrunneae cylindræae utrinque rotundatae, 4-septatae constrictae $39-44 \times 15-17\mu$.

Hab. in foliis *Dichapetali gelonioidis*, Balehonnur, Mysore, *Thirumalachar* 900.

Colonies epiphyllous orbicular dense black velvety, up to 3 mm. diam., crustose. Mycelium of dark brown substraight hyphae $6-8\mu$ thick, the cells mostly $10-20\mu$ long, branching usually opposite at $45-90^\circ$, forming almost a solid plate. Capitulate hyphopodia opposite or alternate, crowded, more or less antrorse, $15-20\mu$ long; head cell clavate to ovate, widely rounded at the apex, entire, straight or bent, $10-14 \times 8-12\mu$; stalk cell cylindric-cuneate, often bent, $2-9\mu$ long. Mucronate hyphopodia not numerous, scattered, opposite or alternate, conoid to ampulliform, more or less bent, $13-20 \times 7-9\mu$, neck 3μ thick. Mycelial setae very numerous, erect, opaque black straight $200-280 \times 9-11\mu$, apex 2-3-dentate to 20μ , the teeth widely divergent. Perithecia in loose central group, black, globose, almost smooth, $120-175\mu$ diam. Spores dark brown, cylindric with widely rounded ends, 4-septate, constricted, $39-44 \times 15-17\mu$ (average $42 \times 16\mu$).

13. *Meliola Elaeagni* sp. nov.

FIGURE 13

Plagulae amphigenae atrae orbiculares 5-8 mm. diam., vel confluentes, tenues. Mycelium ex hyphis atrobrunneis sinuosis $6-7\mu$ crassis (cellulis plerumque $20-25\mu$ longis) oppositè vel irregulariter ramosis ($45-90^\circ$) laxè vel subdense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, $12-23\mu$ longa, cellula basali cylindræa $3-8\mu$ longa, cellula apicali clavata, subglobosa vel leniter angulosa, recta vel subuncinata, integra, apice rotundata vel truncata $9-15 \times 9-14\mu$. Hyphopodia mucronata pauca vel modice numerosa, dispersa, alternata vel opposita, ampullacea curvata $14-18 \times 7-9\mu$, collo curvato angusto $2-3\mu$ crasso. Setae myceliales dispersae paucae vel numerosae, erectae rectae atrae simplices acutae $400-600 \times 8-9\mu$. Perithecia dispersa atra globosa subverrucosa $120-150\mu$ diam. Sporae atrobrunneae cylindræae utrinque rotundatae 4-septatae constrictae $34-40 \times 13-17\mu$.

Hab. in foliis *Elaeagni latifoliae*, Balehonnur, Bangalore, Mysore, 20.8.1944, *Thirumalachar*.

Colonies amphigenous black orbicular 5-8 mm. diam. or confluent, thin. Mycelium of dark brown sinuous hyphae $6-7\mu$ thick, the cells mostly $20-25\mu$ long, branching opposite or irregular at $45-90^\circ$, loosely to subdensely reticulate. Capitulate hyphopodia alternate, straight or bent, at various angles to the hyphae, $12-23\mu$ long; stalk cell cylindric $3-8\mu$ long; head cell clavate, subglobose or slightly angulose, straight or subuncinate,

entire, apex rounded to truncate $9-15 \times 9-14\mu$. Mucronate hyphopodia few to rather numerous, scattered amongst the capitate, alternate or opposite, ampulliform bent $14-18 \times 7-9\mu$, neck bent narrow, $2-3\mu$ thick. Mycelial setae scattered, few to numerous, erect, straight, black, simple, acute, $400-600 \times 8-9\mu$. Perithecia scattered, black, subglobose, slightly verrucose $120-150\mu$ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted $34-40 \times 13-17\mu$ (average $36.5 \times 15\mu$).

14. *Meliola ficicola* sp. nov.

FIGURE 14

Plagulae epiphyllae (*M. ovatipoda* intermixtae) atrae, usque ad 3 mm. diam. vel confluentes, orbiculares subdensae. Mycelium ex hyphis atrobrunneis rectis $7.5-9\mu$ crassis (cellulis plerumque $15-25\mu$ longis) opposita ramosis ($60-90^\circ$) dense reticulatis compositum. Hyphopodia capitata alternata antrorsa, plerumque recta $16-22\mu$ longa, cellula basali cylindracea $3-6\mu$ longa, cellula apicali cylindracea vel clavata, apice rotundata, integra $12-17 \times 8-10\mu$. Hyphopodia mucronata in hyphis paucis dispersa, opposita vel alternata, ampullacea, plus minusve curvata, $15-22 \times 7-10\mu$, collo 4μ crasso. Setae myceliales tenuiter dispersae etiam circum perithecia aggregatae, erectae rectae atrae opacae simplices acutae $200-240 \times 7-9\mu$. Perithecia dispersa atra globosa verrucosa, usque ad 160μ diam., basi hyphis radiantibus circumdata. Sporae atrobrunneae cylindracea vel subellipsoideae utrinque rotundatae, 4-septatae constrictae $37-45 \times 16-18\mu$.

Hab. in foliis *Fici* sp., Balehonnur, Mysore, *Thirumalachar* 894, p.p.

Colonies epiphyllous, mixed with those of *M. ovatipoda*, black, up to 3 mm. diam. or confluent, smooth, orbicular. Mycelium of straight dark brown hyphae $7.5-9\mu$ thick, the cells mostly $15-25\mu$ long, branching usually opposite at $60-90^\circ$, closely reticulate. Capitate hyphopodia alternate, antrorse, usually straight, $16-22\mu$ long; head cell cylindric to slightly clavate with rounded apex, $12-17 \times 8-10\mu$; stalk cell cylindric $3-6\mu$ long. Mucronate hyphopodia mixed with the capitate on few hyphae, usually towards the centre of the colony, opposite or alternate, ampulliform, more or less bent, $15-22 \times 7-10\mu$, the neck 4μ thick. Mycelial setae thinly scattered and grouped around the perithecia, erect, straight simple acute black $200-240 \times 7-9\mu$. Perithecia loosely scattered, each on a radiate subiculum, black globose verrucose, up to 160μ diam. Spores dark brown, cylindric to subellipsoid with rounded ends, 4-septate, constricted $37-45 \times 16-18\mu$ (average $41 \times 17\mu$).

15. *Meliola Gardneriae* sp. nov.

FIGURE 15

Plagulae epiphyllae atrae orbiculares, usque ad 2 mm. diam., densae subvelutinae. Mycelium ex hyphis atrobrunneis, subrectis vel leniter undulatis $7-9\mu$ crassis (cellulis plerumque $10-25\mu$ longis) opposita ramosis ($45-90^\circ$) dense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, $15-28\mu$ longa, cellula basali cylindracea $5-10\mu$ longa, cellula apicali cylindracea, raro subangulosa vel sinuosa, apice rotundata, recta vel curvata $11-20 \times 7-9\mu$. Hyphopodia mucronata dispersa pauca, plerumque alternata, conoidea vel ampullacea, plus minusve curvata $18-27 \times 7-8\mu$. Setae myceliales laxae dispersae, erectae subrectae simplices acutae $300-400 \times 8-9\mu$. Perithecia laxae dispersa atra globosa verrucosa, usque ad 160μ diam. Sporae atrobrunneae cylindracea utrinque rotundatae, 4-septatae constrictae $36-42 \times 17-20\mu$.

Hab. in foliis *Gardneriae* sp., Balehonnur, Mysore, 29.4.1945, *Thirumalachar* 869.

Colonies epiphyllous, up to 2 mm. diam., closely scattered but not confluent, orbicular, black dense numerous subvelvety. Mycelium of substraight to slightly undulate dark brown hyphae $7-9\mu$ thick, the cells mostly $10-25\mu$ long, branching opposite at $45-90^\circ$, closely reticulate. Capitate hyphopodia alternate only, straight or bent, $15-28\mu$ long; head cell cylindric with rounded apex, straight or bent, $11-20 \times 7-9\mu$, occasionally somewhat angulose or sinuous; stalk cell cylindric $5-10\mu$ long. Mucronate hyphopodia scattered, few, mostly alternate, conoid to ampulliform, more or less bent, $18-27 \times 7-8\mu$. Mycelial setae thinly scattered, erect opaque black, substraight simple acute $300-400 \times 8-9\mu$. Perithecia loosely scattered black globose verrucose, up to 160μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted, $36-42 \times 17-20\mu$ (average $40 \times 19\mu$).

16. *Meliola Heyniae* sp. nov.

FIGURE 16

Plagulae epiphyllae atrae orbiculares, usque ad 3 mm. diam., tenues, in conflundo irregulares, tenuiter velutinae. Mycelium ex hyphis atrobrunneis subrectis $6-7\mu$ crassis (cellulis plerumque $15-20\mu$ longis) opposita ramosis ($60-90^\circ$) laxe reticulatis compositum. Hyphopodia capitata alternata late antrorsa ($45-60^\circ$) plerumque recta, $17-21\mu$ longa, cellula basali cylindracea vel cuneata $4-7\mu$ longa, cellula apicali cylindraceo-clavata, apice late rotundata $12-16 \times 8-10\mu$. Hyphopodia mucronata dispersa, modice numerosa, opposita vel alternata, ampullacea vel conoidea, plus minusve curvata, $15-20 \times 7-9\mu$, collo $3-4\mu$ crasso. Setae myceliales plerumque juxta perithecia evolutae, erectae atrae opacae simplices acutae, rectae $160-300 \times 7-8\mu$. Perithecia dispersa atra globosa verrucosa, usque ad 180μ diam., basi hyphis radiantibus circumdata. Sporae atrobrunneae ellipsoideae vel cylindraceae utrinque rotundatae, 4-septatae constrictae $35-45 \times 15-19\mu$.

Hab. in foliis *Heyneae trijugae*, Korekote, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar 874*.

Colonies epiphyllous, thin, black, orbicular or irregular and confluent, thinly velvety, up to 3 mm. diam. Mycelium of substraight dark brown hyphae $6-7\mu$ thick, the cells $15-20\mu$ long, branching opposite at $60-90^\circ$, loosely reticulate. Capitate hyphopodia alternate only, at $45-60^\circ$, usually straight, $17-21\mu$ long; head cell cylindric-clavate, widely rounded at the apex, $12-16 \times 8-10\mu$; stalk cell $4-7\mu$ long. Mucronate hyphopodia mixed with the capitate, fairly numerous, opposite or alternate, ampulliform to conoid, more or less bent, $15-20 \times 7-9\mu$, neck $3-4\mu$ thick. Mycelial setae mostly grouped around the perithecia, erect, black, simple acute, $160-300 \times 7-8\mu$. Perithecia scattered, each with a radiate mycelial subiculum around the base, black globose verrucose, up to 180μ diam. Spores dark brown, ellipsoid to cylindric with rounded ends, 4-septate constricted $35-43 \times 15-19\mu$ (average $40 \times 17\mu$).

17. *Meliola Holarrheniae* sp. nov.

FIGURE 17

Plagulae amphigenae plerumque epiphyllae, late confluentes, tenues atrae, tenuiter velutinae. Mycelium ex hyphis atrobrunneis, subrectis vel leniter sinuosis, $5-7\mu$ crassis (cellulis plerumque $15-25\mu$ longis) opposita ramosis ($45-90^\circ$) laxe vel subdense reticulatis compositum. Hyphopodia capitata alternata, rarissime etiam opposita, antrorsa

vel erecta, plerumque recta, 14–21 μ longa, cellula basali cylindracea 3–7 μ longa, cellula apicali cylindracea vel ovata, apice rotundata, integra 11–16 x 8–10 μ . Hyphopodia mucronata dispersa, alternata vel opposita, ampullacea vel conoidea, plus minusve curvata 15–25 x 5–7 μ , collo 3 μ crasso. Setae myceliales dispersae modice numerosae, erectae rectae atrae acutae simplices 250–450 x 8–9 μ . Perithecia dispersa atra globosa verrucosa 150–190 μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae 30–38 x 12–15 μ .

Hab. in foliis *Holarrheniae antidysentericae*, Balehonnur, Mysore, 18.7.1944, *Thirumalachar*.

Colonies amphigenous, mostly epiphyllous and more or less confluent over the leaf, rather thin, black, thinly velvety. Mycelium of dark brown, substraight or somewhat sinuous hyphae 5–7 μ thick, the cells mostly 15–25 μ long, branching opposite at 45–90°, loosely to rather closely reticulate. Capitate hyphopodia alternate, much less than 1% opposite, antrorse to erect, usually straight, 14–21 μ long; stalk cell cylindric 3–7 μ long; head cell cylindric to ovate with rounded apex, entire, 11–16 x 8–10 μ . Mucronate hyphopodia mixed with the capitate, alternate or opposite, ampulliform to conoid, more or less bent, 15–25 x 5–7 μ , neck 3 μ thick. Mycelial setae scattered, fairly numerous, erect, straight simple acute black 250–450 x 8–9 μ . Perithecia scattered, black, globose, verrucose 150–190 μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted, 30–38 x 12–15 μ (average 34 x 14 μ).

18. *Meliola Ichnocarp* sp. nov.

FIGURE 18

Plagulae amphigenae, plerumque epiphyllae atrae tenues, usque ad 2 mm. diam., vel inconfluendo majores. Mycelium ex hyphis atrobrunneis plus minusve undulatis 5.5–7 μ crassis (cellulis plerumque 20–40 μ longis) opposita ramosis (45–90°) laxe reticulatis compositum. Hyphopodia capitata alternata, plus minusve curvata, 15–30 μ longa, cellula basali cylindracea, recta vel curvata, 3–12 μ longa, cellula apicali subglobosa ovata vel cylindraceo-clavata, apice rotundata, integra saepe curvata 11–18 x 8–12 μ . Hyphopodia mucronata pauca, opposita, alternata vel dispersa, ampullacea curvata 16–22 x 5–9 μ , collo curvato 3 μ crasso. Setae myceliales paucae, dispersae, erectae subrectae simplices, acutae vel subobtusae, atrae 500–1000 x 8–10 μ . Perithecia dispersa atra globosa verrucosa 120–170 μ diam. Sporae atrobrunneae, cylindraceae vel subellipsoideae utrinque rotundatae, 4-septatae constrictae 35–41 x 14–17 μ .

Hab. in foliis *Ichnocarp* frutescentis, Hirethola, Thirthahalli, Mysore, 3.4.1945, *Thirumalachar* 856.

Colonies amphigenous, mostly epiphyllous, black, thin, up to 2 mm. diam. or confluent and larger. Mycelium of more or less undulate dark brown hyphae 5.5–7 μ thick, the cells 20–40 μ long, mostly about 30 μ ; branching opposite at 45–90°, loosely reticulate. Capitate hyphopodia alternate, more or less bent, 15–30 μ long; head cell subglobose, ovate or cylindric-clavate, apex rounded, entire, often bent, 11–18 x 8–12 μ ; stalk cell cylindric, straight or bent 3–12 μ long. Mucronate hyphopodia few, opposite, alternate or scattered, mixed with the capitate hyphopodia, ampulliform, bent, 16–22 x 5–9 μ , neck bent, 3 μ thick. Mycelial setae rather few, thinly scattered, erect, more or less straight, simple, acute to subacute, black opaque 500–1000 x 8–10 μ thick at the base. Perithecia thinly scattered black globose verruculose 120–170 μ diam. Spores dark brown, cylin-

dric to subellipsoid with rounded ends, 4-septate constricted $35-41 \times 14-17\mu$.

19. *Meliola Kydiae-calycinae* sp. nov.

FIGURE 19

Plagulae amphigenae plerumque epiphyllae, orbiculares usque ad 4 mm. diam., atrae densae velutinae, saepe numerosae et late confluentes. Mycelium ex hyphis atrobrunneis sinuosis $7-9\mu$ crassis (cellulis $20-30\mu$ longis) opposita vel irregulariter ramosis ($60-90^\circ$) dense reticulatis compositum. Hyphopodia capitata alternata suberecta $15-24\mu$ longa, recta vel curvata, cellula basali cylindracea $4-10\mu$ longa, cellula apicali irregulariter angulosa vel sub-3-lobata, recta vel curvata, $10-15 \times 12-19\mu$. Hyphopodia mucronata pauca, in hyphis distinctis evoluta, opposita vel alternata, ampullacea vel conoidea $16-23 \times 6-8\mu$, collo $3-4\mu$ crasso. Setae myceliales numerosae, dense dispersae et juxta perithecia aggregatae, erectae rectae vel irregulariter curvatae, haud hamatae, opacae simplices, acutae vel apiculato-acutae (rarissime obtusae) $220-340 \times 11-14\mu$. Perithecia dispersa atra globosa usque ad 180μ diam., cellulis parietis late conoideis prominentibus. Sporae anguste ellipsoideae vel cylindraceae, atrobrunneae utrinque rotundatae, 4-septatae, leniter constrictae $33-39 \times 10-12\mu$.

Hab. in foliis *Kydiae calycinae*, Agumbe, Mysore, 4.4.1945, *Thirumalachar* 852.

Colonies amphigenous, mostly epiphyllous, orbicular, up to 4 mm. diam., black, dense, velvety, often numerous and subconfluent over the whole leaf. Mycelium of crooked dark brown hyphae $7-9\mu$ thick, the cells $20-30\mu$ long, branching opposite or irregular at $60-90^\circ$, densely reticulate. Capitulate hyphopodia alternate at wide angles, $15-24\mu$ long, straight or bent; head cell irregularly angulose to sub-3-lobed, straight or bent, usually broader than long, $10-15 \times 12-19\mu$; stalk cell cylindric $4-10\mu$ long. Mucronate hyphopodia rather few, on separate hyphae, opposite or alternate. ampulliform to conoid $16-23 \times 6-8\mu$, neck $3-4\mu$ thick. Mycelial setae numerous, closely scattered over the mycelium and grouped around the base of the perithecia, erect, straight or irregularly bent, not hamate, opaque black to the tips, simple, rarely obtuse, usually acute to apiculate-acute, $220-340 \times 11-14\mu$. Perithecia closely scattered over the colony, black globose verrucose, up to 180μ diam.; the surface cells broadly conoid; entirely without setae. Spores narrowly ellipsoid to cylindric with rounded ends, dark brown, 4-septate, slightly constricted $33-39 \times 10-12\mu$ (average $35 \times 11.5\mu$).

20. *Meliola Mangiferae* Earle in Bull. New York Bot. Gard. 3: 307. 1905.

FIGURE 20

On *Mangifera indica*, Thirthahalli, Mysore, *Thirumalachar* 877 p.p.

Colonies amphigenous black orbicular, up to 3 mm. diam., dense and velvety. Mycelium of substraight dark brown hyphae $8-9\mu$ thick, the cells mostly $20-25\mu$ long, branching usually opposite at $45-60^\circ$, densely reticulate. Capitulate hyphopodia alternate or very rarely opposite, usually more or less antrorse, straight or variously bent, $18-35\mu$ long; stalk cell cylindric $5-11\mu$ long; head cell cylindric-clavate with rounded apex, often bent, less commonly ovate to rounded-angulose or somewhat irregular, $12-24 \times 10-13\mu$. Mucronate hyphopodia scattered, alternate or opposite, ampulliform, more or less bent, $18-25 \times 7-9\mu$, with elongate neck 4μ thick.

Mycelial setae numerous, erect straight black, up to 600μ long by $9-11\mu$ thick, attenuate above to the obtuse or more commonly very shortly 2-3-dentate apex. Perithecia scattered black globose verrucose up to 220μ diam. Spores dark brown, ellipsoid with rounded ends, 4-septate, constricted, $48-54 \times 23-27\mu$.

21. *Meliola Memecyli* Sydow in Ann. Mycol. 12: 198. 1914.

FIGURE 21

On *Memecylon Talbotianum*, Agumbe, Mysore, 5.4.1945, *Thirumalachar* 870.

Colonies amphigenous black orbicular 1-3 mm. diam., dense, velvety, numerous, closely scattered and sometimes confluent. Mycelium of dark brown substraight hyphae $8-10\mu$ thick, the cells mostly $20-25\mu$ long; branching opposite at $45-90^\circ$, closely reticulate. Capitulate hyphopodia alternate or very rarely opposite, $16-23\mu$ long, more or less antrorse; head cell widely cylindric-clavate with rounded apex, entire, $11-16 \times 10-12\mu$; stalk cell cylindric $3-8\mu$ long. Mucronate hyphopodia scattered, opposite or alternate, bent ampulliform to conoid, $17-28 \times 8-10\mu$, the neck $3-5\mu$ thick. Mycelial setae numerous, scattered over the mycelium and also grouped around the perithecia, erect straight or slightly bent, opaque black, simple, obtuse, up to $1600 \times 9-12\mu$. Perithecia scattered, black globose verrucose, $140-210\mu$ diam. Spores dark brown, cylindric with rounded ends, 4-septate, rather deeply constricted, $38-46 \times 17-21\mu$ (average $42 \times 19\mu$).

From the above the collection on *Memecylon edulis*, Bannerghatta, Bangalore, Mysore, 24.12.1944, *Thirumalachar*, differs somewhat:

FIGURE 22

The colonies are rather larger; capitulate hyphopodia up to 1% opposite, often slightly narrower; mycelial setae only up to 700μ long with apex obtuse or 2-4-dentate (-8μ); perithecia up to 220μ diam., and spores cylindric to subellipsoid, $42-51 \times 18-23\mu$, averaging $47 \times 20\mu$.

22. *Meliola ovatipoda* sp. nov.

FIGURE 23

Plagulae epiphyllae atrae tenues orbiculares, usque ad 3 mm. diam., vel confluentes. Mycelium ex hyphis atrobrunneis subrectis vel undulatis, 6μ crassis (cellulis $15-20\mu$ longis) opposita ramosis ($60-90^\circ$) laxe reticulatis compositum. Hyphopodia capitata alternata, antrorsa, plerumque recta $18-29\mu$ longa, cellula basali cylindracea $4-15\mu$ longa, cellula apicali ovata integra $10-16 \times 9-12\mu$. Hyphopodia mucronata in hyphis distinctis evoluta, opposita vel alternata, ampullacea, plus minusve curvata $15-22 \times 6-8\mu$, collo 3μ crasso. Setae myceliales praecipue juxta perithecia evolutae, erectae atrae opacae, subrectae vel irregulariter curvatae, haud hamatae, simplices acutae, usque ad $200 \times 8-9\mu$. Perithecia laxa dispersa, atra globosa verrucosa, usque ad 160μ diam., basi hyphis radiantibus circumdata. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae $29-37 \times 13-16\mu$.

Hab. in foliis *Fici* sp., Balehonnur, Mysore, *Thirumalachar* 894 p.p.

Colonies epiphyllous, (mixed with *M. ficicola* and distinguished from this by the thinner colonies with rather more flexuous mycelium, narrower hyphae with different hyphopodia) thin, black orbicular smooth, up to 3

mm. diam. or confluent. Mycelium of substraight to slightly wavy dark brown hyphae 6μ thick, the cells $15-20\mu$ long, branching opposite at $60-90^\circ$, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, usually straight, $17-29\mu$ long; head cell ovate entire, $10-16 \times 9-12\mu$; stalk cell cylindric $4-15\mu$ long. Mucronate hyphopodia on separate hyphae, opposite or alternate, ampulliform, more or less bent, $15-22 \times 6-8\mu$, the neck 3μ thick. Mycelial setae usually only around the perithecia, few, erect black substraight or irregularly bent but not uncinatate or hamate, simple acute, up to $200 \times 8-9\mu$. Perithecia loosely scattered, each on a radiate subiculum of hyphopodiate hyphae, black, globose, verrucose, up to 160μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted $29-37 \times 13-16\mu$ (average $32 \times 14\mu$).

23. *Meliola tabernaemontanicola* sp. nov.

FIGURE 24

Plagulae epiphyllae, raro etiam hypophyllae, atrae, tenues vel subdensae, orbiculares, usque ad 4 mm. diam., velutinae, saepe numerosae confluentesque. Mycelium ex hyphis atrobrunneis, subrectis vel leniter undulatis $6-7\mu$ crassis (cellulis plerumque $20-25\mu$ longis) oppositè ramosis ($45-90^\circ$) laxè vel subdense reticulatis compositum. Hyphopodia capitata alternata, rarissime opposita, plus minusve antrorsa, plerumque recta, $15-24\mu$ longa, cellula basali cylindracea $3-9\mu$ longa, cellula apicali ovata vel cylindracea, apice rotundata integra $12-17 \times 8-10\mu$. Hyphopodia mucronata dispersa, opposita vel alternata, curvata ampullacea $13-19 \times 6-8\mu$, collo 3μ crasso. Setae myceliales numerosae dispersae et juxta perithecia aggregatae, erectae, rectae vel curvulae, simplices acutae atrae $200-450 \times 7-9\mu$. Perithecia dispersa atra globosa verrucosa, usque ad 170μ diam. Sporae atrobrunneae, cylindraceae utrinque rotundatae, 4-septatae constrictae $30-36 \times 13-15\mu$.

Hab. in foliis *Tabernaemontanae* sp., Balehonnur, Mysore, 28.8.1944, *Thirumalachar* 860.

Colonies epiphyllous, rarely also hypophyllous, black, thin to subdense, orbicular, up to 4 mm. diam., or numerous and confluent, velvety. Mycelium of substraight to slightly undulate dark brown hyphae $6-7\mu$ thick, the cells mostly $20-25\mu$ long, branching opposite at $45-90^\circ$, loosely to subdensely reticulate. Capitate hyphopodia alternate, very rarely opposite, more or less antrorse, usually almost straight, $15-24\mu$ long; head cell ovate to cylindric with rounded apex, entire, $12-17 \times 8-10\mu$; stalk cell cylindric $3-9\mu$ long. Mucronate hyphopodia scattered, opposite or alternate, bent ampulliform $13-19 \times 6-8\mu$, the neck 3μ thick. Mycelial setae numerous, scattered and also grouped around the perithecia, erect straight or slightly bent, simple, acute black $200-450 \times 7-9\mu$. Perithecia scattered black globose verrucose, up to 170μ diam. Spores dark brown, cylindric with rounded ends, 4-septate constricted $30-36 \times 13-15\mu$ (average $34 \times 14\mu$).

24. *Meliola Tecleae* Hansf. var. *Toddaliae-asiaticae* Hansf. in Proc. Linn. Soc. London, Session 153, p. 11. 1941.

FIGURE 25

On *Toddalia asiatica* var. *floribunda*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar* 875.

Colonies epiphyllous orbicular scattered, up to 3 mm. diam., black dense velvety. Mycelium of straight dark brown hyphae $8-9\mu$ thick. the cells

15–30 μ long, branching opposite at 60–90°, closely reticulate. Capitate hyphopodia alternate, very rarely opposite, more or less widely antrorse, usually straight, 19–24 μ long; head cell cylindric to clavate with rounded apex, entire, 13–18 x 9–12 μ . Mucronate hyphopodia mixed with the capitate, opposite or alternate conoid to ampulliform, 15–22 x 7–10 μ , the neck more or less bent, 4–5 μ thick. Mycelial setae numerous scattered erect black opaque simple acute rigid, 300–500 x 10–12 μ . Perithecia closely scattered, black globose verrucose 140–190 μ diam. Spores dark brown, cylindric to ellipsoid with rounded ends, constricted 4-septate 40–47 x 17–20 μ (average 45 x 18.5 μ).

25. *Meliola toddaliicola* Hansf. var. *indica* var. nov.

FIGURE 26

Plagulae paucae, dispersae atrae densae orbiculares, usque ad 3 mm. diam., epiphyllae. Mycelium ex hyphis atrobrunneis subrectis 6–7 μ crassis (cellulis plerumque 13–20 μ longis) opposita ramosis (saepe 90°) dense reticulatis compositum. Hyphopodia capitata opposita vel usque ad 30% alternata, late antrorsa, 13–20 μ longa, cellula basali cylindracea 2–5 μ longa, cellula apicali late ovata, integra 10–15 x 8–10 μ . Hyphopodia mucronata dispersa, opposita vel alternata, ampullacea, curvata 12–20 x 7–9 μ , collo 3–4 μ crasso. Setae myceliales praecipue juxta perithecia evolutae, erectae atrae rectae opacae simplices acutae 200–280 x 7–9 μ . Perithecia dispersa atra globosa verrucosa 120–150 μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4-septatae leniter constrictae 39–44 x 15–17 μ .

Hab. in foliis *Toddaliae asiaticae* var. *floribundae*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar* 875 p.p.

Colonies few, scattered black dense up to 3 mm. diam., orbicular, epiphyllous. Mycelium of substraight dark brown hyphae 6–7 μ thick, the cells 15–20 μ long, branching opposite subrectangular, closely reticulate. Capitate hyphopodia opposite or up to 30% alternate, widely antrorse, 13–20 μ long; head cell wide ovate entire 10–15 x 8–10 μ ; stalk cell cylindric 2–5 μ long. Mucronate hyphopodia scattered, opposite or alternate, ampulliform, bent, 12–20 x 7–9 μ , neck 3–4 μ thick. Mycelial setae mostly grouped around the perithecia, erect straight black opaque simple acute 200–280 x 7–9 μ . Perithecia scattered black globose verrucose, 120–150 μ diam. Spores dark brown cylindric with rounded ends, 4-septate constricted 39–44 x 15–17 μ (41 x 16 μ).

26. *Meliola Zizyphi* sp. nov.

FIGURE 27

Plagulae epiphyllae tenues atrae orbiculares, tenuiter velutinae, usque ad 3 mm. diam., vel numerosae confluentesque. Mycelium ex hyphis atrobrunneis subrectis vel undulatis 5–6 μ crassis (cellulis 20–30 μ longis) opposita ramosis, subrectangulariter laxeque reticulatis compositum. Hyphopodia capitata alternata vel usque ad 5% opposita late antrorsa vel reflexo-curvata 10–17 μ longa, cellula basali cylindracea 2–6 μ longa, cellula apicali cylindraceo-clavata, saepe curvata, integra 8–12 x 7–9 μ . Hyphopodia mucronata dispersa, haud numerosa, opposita vel alternata, ampullacea, plus minusve curvata, 13–19 x 5–7 μ , collo elongato 3 μ crasso. Setae myceliales laxae dispersae, erectae atrae simplices acutae, rectae vel leniter curvatae (haud uncinatae) 250–400 x 6–7 μ . Perithecia dispersa atra globosa verrucosa 120–140 μ diam. Sporae at-

robrunneae cylindraceae utrinque rotundatae, 4-septatae leniter constrictae 30-36 x 11-14 μ .

Hab. in foliis *Zizyphi rugosae*, Balehonnur, Mysore, 28.4.1945, *Thirumalachar* 850.

Colonies epiphyllous, thin black orbicular, thinly velvety, up to 3 mm. diam., or numerous and confluent over the leaf. Mycelium of substraight to undulate or slightly crooked hyphae, dark brown, 5-6 μ thick, the cells 20-30 μ long, branching opposite and subrectangular, loosely reticulate. Capitate hyphopodia alternate or up to 5% opposite, at wide angles and often reflexed-bent, 10-17 μ long; head cell cylindric-clavate, often bent, entire, 8-12 x 7-9 μ ; stalk cell cylindric 2-6 μ long. Mucronate hyphopodia scattered, not numerous, opposite, alternate or solitary, ampulliform, more or less bent, 13-19 x 5-7 μ , neck elongate 3 μ thick. Mycelial setae thinly scattered erect black simple acute, straight or somewhat bent, not uncinat, 250-400 x 6-7 μ . Perithecia scattered loosely, black globose verrucose, 120-140 μ diam. Spores dark brown, cylindric with rounded ends, 4-septate constricted 30-36 x 11-14 μ (average 34 x 12.5 μ).

27. *Dimeriella Salaciae* sp. nov.

FIGURE 28

Plagulae hypophyllae, haud perspicues; mycelium ex hyphis superficialibus hyalinis exhyphopodiatis 2-3.5 μ crassis, indistincte septatis, irregulariter denesque ramosis, laxe reticulatis compositum. Setae myceliales laxae dispersae, ex nodo mycelii ortae, erectae simplices obtusae septatae atrobrunneae subrectae 300-450 μ alt., 4-5 μ cr., apice 3 μ crassae. Perithecia laxae dispersa superficialia globosa 60-100 μ diam. atra, basi hyphis mycelii circumdata; paries unistratosus ex cellulis angulosis brunneis 10 μ diam. et 5 μ cr. compositus, sursum cellulis in circulos circum poro apicalum dispositis; porus circa 15 μ diam. Setae peritheciales erecto-patentes, ex parte superiore perithecii ortae, 15-23, atrobrunneae, rectae septatae simplices obtusae 50-110 x 4-5 μ . Asci numerosi paraphysati erecti, late ellipsoidei vel saccati, apice rotundati incrassati (-14 μ) sessiles, 8-spori, 50 x 20 μ . Sporae multiseriatae vel sub-parallelae, cylindraceae vel leniter clavulatae, utrinque rotundatae, hyalinae, 1-septatae haud constrictae, leves 18-22 x 3.5-4 μ .

Hab. in foliis *Salaciae* sp., Balehonnur, Mysore, *Thirumalachar*.

Hypophyllous, not forming visible colonies; mycelium of superficial hyaline exhyphopodiate hyphae 2-3.5 μ thick, indistinctly septate, irregularly and closely branched, forming a loose reticulum. Mycelial setae thinly scattered, each arising from a small knot of pale brown mycelial hyphae, erect, simple obtuse septate, dark brown, more or less straight, 300-450 x 4-5 μ , gradually attenuate to 3 μ at the apex. Perithecia loosely scattered, completely superficial, globose 60-100 μ diam., black; wall of a single layer of angular parenchyma, brown, about 10 μ diam. and 5 μ thick; towards the apex the cells somewhat smaller and arranged in irregular rings about the slightly papillate terminal round pore, which is about 15 μ diam. Perithecial setae erect-spreading, arising from the upper half of the perithecial wall, 15-23, dark brown, straight, septate, simple, obtuse, 50-110 x 4-5 μ . Asci numerous, paraphysate, erect, broadly ellipsoid to saccate, rounded and when young thickened at the apex to 14 μ , sessile, 8-spored, 50 x 20 μ . Spores multiseriate or subparallel, cylindric to slightly clavulate

with rounded ends, hyaline, 1-septate, not constricted, smooth, $18-22 \times 3.5-4 \mu$.

The mycelium with its setae are closely akin to those of the family Chaetothyriaceae, but the globose perithecium with its parenchymatous wall and round apical pore separate the fungus from that family, and there is no trace of an outer mycelial covering on the perithecium.

✓ 28. *Chaetothyrum mysorensis* sp. nov.

FIGURE 29

Mycelium epiphyllum, late effusum, ex hyphis hyalinis $2-3 \mu$ crassis, indistincte septatis, laxe reticulatis compositum, juxta perithecia dense reticulatum pelliculosum. Setae myceliales juxta perithecia aggregatae, interdum etiam laxe dispersae, erectae, opae aetiae, rectae simplices acutae, usque ad $200 \times 8-10 \mu$. Perithecia laxa dispersa, superficialia glabra atra nitentia depresso-globosa, $150-210 \mu$ diam. et circa 70μ alt., in sicco cupulato-collapsa. Paries exterior ex hyphis sinuosis $2-4 \mu$ crassis compositus, plectenchymaticus, atrobrunneus; paries interior ex cellulis angulosis hyalinis $3-5 \mu$ diam. compositus, totus circa 5μ crassus. Asci numerosi basales erecti aparaphysati, late clavati, superne late rotundati, haud incrassati, subsessiles, tenuiter tunicati, in maturitate $55-60 \times 20-25 \mu$, 8-sporei. Sporae parallelae cylindraceo-clavulatae, rectae vel leniter curvatae, utrinque rotundatae, hyalinae, leves, transverse $7-9$ -septatae, haud constrictae, $45-50 \times 5 \mu$.

Hab. in foliis *Salaciae* sp., Balehonnur, Mysore, 28.3.1945, *Thirumalachar*.

Mycelium epiphyllous, not forming visible colonies, widely spreading, hyaline, thin, loosely reticulate, of indistinctly septate thin-walled hyphae $2-3 \mu$ thick, becoming closely reticulate and thinly pelliculose around the setae and perithecia. Setae usually grouped around each perithecium, sometimes also scattered irregularly and thinly over the mycelium, erect, black, straight, simple acute, up to $200 \times 8-10 \mu$, quite opaque from base to tip. Perithecia loosely scattered, each surrounded by a ring of $6-10$ mycelial setae, otherwise quite glabrous and smooth, black, shining, flattened globose, when dry cupulate-collapsed, $150-210 \mu$ diam., about 70μ high, completely superficial. Upper and outer wall of dark brown wavy plectenchyma continuous with the mycelial pellicle around the base and fused above with the inner true wall of delicate angular parenchyma $3-5 \mu$ diam.; whole wall about 5μ thick. Asci numerous, basal erect aparaphysate, broadly clavate, widely rounded above, not thickened at the apex, attenuate downwards to the sessile base, thin-walled, when mature $55-60 \times 20-25 \mu$. Spores 8, parallel, cylindric-clavulate straight or slightly bent, the ends rounded, hyaline smooth, transversely $7-9$ -septate, not constricted, $45-50 \times 5 \mu$.

✓ 29. *Hariotula Capparidis* sp. nov.

Maculae epiphyllae rotundatae indistincte marginatae, elevatae, subinde inferne invaginatae, circa 5 mm. diam., ochraceae, haud secedentes, ab hypophyllo haud perspicuae. Mycelium externum nullum; internum ex plagulis rotundatis hyalinis in cellulis epidermidis folii compositum. Thyriothecia superficialia atra rotundata discretata laxa dispersa, epiphylla, $120-160 \mu$ diam., convexa levia, margine haud fimbriata; paries inferior ex hyphis hyalinis angustis radiantibus indistinctis compositus; paries superior ex hyphis radiantibus atrobrunneis $4-6 \mu$ crassis (cellulis $6-10 \mu$ longis) compositus, in maturitate irregulariter dehiscens et cellulis centralibus secedentibus. Asci

3-6, globosi sessiles, tenuiter tunicati, 8-spori $35-40\mu$ diam., aparaphysati. Sporae conglobatae, atrobrunneae, oblongae utrinque rotundatae, 1-septatae constrictae leves $22-26 \times 12-13\mu$, cellula superiore leniter crassiore.

Hab. in foliis *Capparis sepiariae*, Nandi, Mysore, 16.11.1944, *Thirumalachar*.

Leafspots epiphyllous, circular, rather indefinite, raised and sometimes invaginated below, about 5 mm. diam., yellowish brown, not drying out, not visible from the lower surface of the leaf. Upper epidermis filled with orange to yellow oil drops, often simulating a septate mycelium. Internal mycelium in the upper part of the epidermal cells, consisting of hyaline plates of flattened cells about $6-9\mu$ diam., forming thin plates closely adherent to the upper wall of the host cell, passing directly from one cell to the next. Thyriothecia superficial, black, circular, discrete, loosely scattered, epiphyllous only, $120-160\mu$ diam., convex, smooth, not fimbriate at the edge; lower wall of hyaline delicate hyphae radiating from the central point of attachment through the cuticle to the internal mycelium, very difficult to see; upper wall of dark brown radiating hyphae $4-6\mu$ thick, the cells $6-10\mu$ long, at maturity irregularly dehiscent in the centre, and then the central cells falling away. Asci 3-6, globose, sessile, thin-walled, 8-spored, about $35-40\mu$ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, constricted, smooth, $22-26 \times 12-13\mu$, the upper cell slightly larger than the lower.

30. *Hariotula Convolvuli* sp. nov.

Thyriothecia epiphylla, dense aggregata, atra rotundata convexa; plerumque discreta $80-120\mu$ diam., sine mycelium externum; paries inferior hyalinus indistinctus; paries superior ex hyphis radiantibus atrobrunneis $4-5\mu$ crassis (cellulis $5-8\mu$ longis) compositus, margine haud fimbriatus, irregulariter stellatim dehiscens usque ad marginem. Thyriothecia centraliter ad mycelium hyalinum subcuticulare ex hyphis septatis $3-4\mu$ crassis compositum conjuncta, haustoriis nullis. Asci 6-10, in ordine maturescentes, globosi sessiles 8-spori, circa 20μ diam., aparaphysati. Sporae conglobatae brunneae oblongae utrinque rotundatae, 1-septatae, leniter constrictae, leves $12-15 \times 6-7.5\mu$ cellula superiore saepe leniter crassiore.

Hab. in foliis *Convolvuli* sp., Bangalore, Mysore, 11.11.1944, *Thirumalachar*.

Thyriothecia epiphyllous, closely scattered and covering an irregular area of the leaf, without superficial mycelium, black, circular convex, usually discrete, $80-120\mu$ diam.; upper wall at first of somewhat radiating dark brown hyphae $4-5\mu$ thick, the cells $5-8\mu$ long, not fimbriate at the margin, dehiscent by irregularly stellate fissures to the margin and the segments becoming erect and more or less surrounding the exposed ascus layer, which is embedded in pale brownish mucus; lower thyriothecial wall hyaline, very indistinct. Asci 6-10, ripening in succession, sessile, globose, thin-walled, 8-spored, about 20μ diam., aparaphysate. Spores conglobate, brown, oblong with rounded ends, 1-septate, slightly constricted, smooth, $12-15 \times 6-7.5\mu$, the upper cell often slightly larger than the lower. The thyriothecia are centrally attached to a subcuticular hyaline mycelium of septate hyphae $3-4\mu$ thick, spreading over the epidermal cells without formation of haustoria.

The fungus is somewhat closely allied to *Ferrarisia Ipomoeae*, but differs in its internal mycelium.

31. *Stephanotheca Oleae* sp. nov.

FIGURE 30

Thyriothezia hypophylla rotundata discoidea atra levia, usque ad 240μ d'am., plerumque discreta, dense dispersa, omnino superficialia sine mycelium perspicuum. Paries superior ex hyphis atrobrunneis radiantibus $4-5\mu$ crassis (cellulis $5-8\mu$ longis) compositus, margine crenatus, haud fimbriatus, irregulariter dehiscens. Paries thyriothezii inferior ex hyphis dilute brunneis vel subhyalinis indistincte radiantibus compositus. Asci in hymenio annulato dispositi, numerosi apophysati subglobosi vel ovati, nodoso-stipitati $25-35 \times 20-25\mu$, 8-sporei, apice incrassati -2μ . Sporae conglobatae hyalinae ovato-ellipsoideae utrinque rotundatae, transverse 3-septatae, haud vel leniter constrictae, leves $13-15 \times 5-6\mu$, cellulis centralibus longitudinaliter 1-septatis.

Hab. in foliis *Oleae dioicae*, Balehonnur, Mysore, *Thirumalachar* 887.

Thyriothezia hypophyllous, circular, discoid, flat, black, smooth, up to 240μ diam., closely scattered but usually discrete, apparently completely superficial and with no evident free mycelium. Upper wall of dark brown radiate hyphae $4-5\mu$ thick, the cells $5-8\mu$ long, the marginal cells up to 10μ long, crenate at the margin but not fimbriate, the terminal cells of the hyphae somewhat loose. Lower wall of indistinctly radiating pale brown to subhyaline hyphae. Dehiscence is by irregular fracture of the upper wall. The asci are arranged in a close hymenium extending all round the sterile centre, separated by the loose remains of the stroma tissue of globose subhyaline cells $3-5\mu$ diam. Asci subglobose to ovate, contracted below into a short nodose stipe, $25-35 \times 20-25\mu$, apophysate 8-spored, with wall thickened up to 2μ around the apex. Spores more or less conglobate, hyaline, ovate-ellipsoid with rounded ends, transversely 3-septate, not or slightly constricted, smooth, the middle cells with one longitudinal septum, $13-15 \times 5-6\mu$.

32. *Asterolibertia Mangiferae* sp. nov.

FIGURE 31

Plagulae epiphyllae atrae orbiculares, usque ad 7 mm. diam., dispersae tenues leves. Mycelium ex hyphis atrobrunneis subrectis 7μ crassis (cellulis plerumque $20-30\mu$ longis) oppositae vel irregulariter ramosis ($45-90^\circ$) laxae reticulatis compositum. Hyphopodia intercalaria dispersa solitaria, in hyphis primariis efformata, doliformia $12-15 \times 10-11\mu$, continua, inferne poro conspicuo perforata. Ascomata dispersa, plerumque discreta, atra rotundata convexa levia, $250-300\mu$ diam., paries inferior indistinctus; paries superior ex hyphis radiantibus opace atrobrunneis 5μ crassis (cellulis $5-12\mu$ longis) compositus, margine fimbriatus, hyphis fimbriarum subtiliter undulatis, radiantibus, usque ad 160μ longis, exhyphopodiatis; thyriotheций irregulariter dehiscens et cellulis centralibus secendentibus. Asci usque ad 15, in ordine maturescentes, apophysati globosi sessiles, usque ad 70μ diam., 4-8-sporei. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, rectae vel leniter curvatae, 1-septatae constrictae leves $35-42 \times 16-19\mu$, cellulis subaequalibus vel superiore leniter crassiore. Pycnidia et conidia nulla.

Hab. in foliis *Mangiferae indicae*, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar* 877.

Colonies epiphyllous, black orbicular, up to 7 mm. diam., discrete, scattered, thin, smooth. Mycelium of straight dark brown hyphae 7μ thick, the cells mostly $20-30\mu$ long, branching opposite or irregular at $45-90^\circ$, loosely reticulate. Hyphopodia intercalary, scattered singly on the main hyphae only, not regularly distributed, barrel-shaped $12-15 \times 10-11\mu$, with a conspicuous pore on the lower surface. Ascomata scattered, usually

discrete, black rounded, flattened conic, smooth, 250–300 μ diam.; lower wall indistinct; upper wall of opaque black-brown radiating hyphae 5 μ thick, the cells cubical in the centre, up to 12 μ long towards the margin; margin fimbriate, the fringing hyphae finely undulate, radiating, up to 160 μ long, exhyphopodiate; dehiscence irregularly stellate, the centre breaking up and falling away. Asci up to 15, ripening in succession, paraphysate, globose sessile, up to 70 μ diam. when fully mature, 4–8-spored. Spores conglobate, dark brown, oblong with rounded ends, straight or slightly bent, 1-septate, constricted, smooth, 35–42 x 16–19 μ , the cells subequal or the upper slightly larger. Pycnidia and conidia none.

33. *Asterina cansjericola* sp. nov.

FIGURE 32

. Plagulae amphigenae atrae numerosae subdensae orbiculares, plerumque discretae 3–4 mm. diam., leves. Mycelium ex hyphis atrobrunneis, subrectis vel leniter sinuosis 5–7 μ crassis (cellulis plerumque 25–40 μ longis) opposita vel irregulariter ramosis (45–60°) laxe reticulatis compositum. Hyphopodia alternata vel unilateralia, interdum (–5%) opposita, conoidea, plerumque leniter curvata, atrobrunnea 12–16 x 6–8 μ , sursum leniter attenuata, apice rotundata 4–5 μ crassa. Thyriothecia dense dispersa, numerosa rotundata convexa atra, usque ad 160 μ diam. vel 2–3-connata; paries inferior hyalinus subradiatus indistinctus; paries superior subopace atrobrunneus ex hyphis radiantibus 4–5 μ crassis (cellulis 5–10 μ longis) compositus, stellatim dehiscens et cellulis centralibus secedentibus, margine subfimbriatus, hyphis fimbriarum dilute brunneis, tortuoso-radiantibus exhyphopodiatis, usque ad 40 μ longis. Asci 4–6, in ordine maturescentes paraphysati globosi vel ellipsoidei, 8-sporei, usque ad 50 x 40–45 μ . Sporae conglobatae atrobrunneae, oblongae utrinque rotundatae, 1-septatae, fortiter constrictae 28–34 x 14–17 μ , exosporio tenuiter denseque echinulato. Pycnidia thyriotheciis consimilia; pycnosporae piriformes atrobrunneae leves continuae, circa 27 x 18 μ .

Hab. in foliis *Cansjeræ Rheedii*, Nandi Hills, Mysore, 18.11.1944, *Thirumalachar*.

Colonies amphigenous, black, numerous, rather dense, rounded, usually discrete, 3–4 mm. diam., smooth. Mycelium of substraight or slightly sinuous dark brown hyphae 5–7 μ thick, the cells mostly 25–40 μ long, branching opposite or irregular at 45–60° loosely reticulate. Hyphopodia alternate or unilateral, in some colonies up to 5% opposite, conoid, usually slightly bent, dark brown, 12–16 x 6–8 μ thick at the base, slightly attenuate to the rounded apex 4–5 μ thick. Thyriothecia densely scattered, numerous, circular convex black, up to 160 μ diam., or 2–3-connate into irregular compound ascomata; lower wall indistinct, hyaline, subradiate; upper wall subopaque dark brown, radiate, the hyphae 4–5 μ thick with cells 5–10 μ long; dehiscence by stellate fissures and the central parts falling away; margin usually slightly fimbriate, the fringing hyphae paler than the mycelium, tortuous-radiating, exhyphopodiate, up to 40 μ long. Asci few, 4–6, ripening in succession, globose to ellipsoid, 8-spored, paraphysate, up to 50 μ high by 40–45 μ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, deeply constricted 28–34 x 14–17 μ , exospore finely and closely echinulate. Pycnidia similar to the thyriothecia; pycnosporae piriform, dark brown, smooth, about 27 x 18 μ , without a hyaline band or prominent germ pores.

34. *Asterina congesta* Cooke in Grevillea 8: p. 95. 1879.

FIGURE 33

On *Santalum album*, Nandi Hills, Mysore, 14.10.1944, *Thirumalachar*.

Colonies amphigenous, mostly epiphyllous, black, circular, rather dense, smooth, up to 2 mm. diam., or numerous and confluent, especially on the lower surface. Mycelium of crooked dark brown hyphae $4-5\mu$ thick, the cells mostly $10-15\mu$ long, branching opposite or irregular, closely reticulate. Hyphopodia alternate or unilateral, continuous, dark brown, irregularly conoid or digitate, sometimes somewhat sinuous-lobate, apex obtuse, straight or bent, $5-10 \times 4-8\mu$. Thyriothecia numerous, closely scattered and in the centre of the colony almost a solid plate; circular and discrete, up to 130μ diam., or more often confluent into large, very irregular X- or Y-shaped compound ascomata up to 280μ long. Lower wall indistinct. Upper wall of radiating dark brown hyphae $4-5\mu$ thick, the cells $4-8\mu$ long not or only slightly fimbriate at the margin; dehiscence by stellate fissures extending to the margin, into broadly triangular segments, partly exposing the asci. Asci 4-10, paraphysate, globose, sessile 8-spored, $35-40 \times 28-35\mu$, ripening in succession. Spores conglobate dark brown, oblong with rounded ends, 1-septate, constricted, smooth, $18-23 \times 10-11\mu$, the upper cell slightly larger than the lower.

35. *Asterina Dichapetali* sp. nov.

FIGURE 34

Plagulae epiphyllae tenues atrae leves orbiculares, usque ad 3 mm. diam., saepe confluentes. Mycelium ex hyphis sinuosis atrobrunneis $4-5\mu$ crassis (cellulis plerumque $15-20\mu$ longis) oppositae vel irregulariter ramosae, dense reticulatis compositum. Hyphopodia continua, alternata vel unilateralia, suberecta, subrecta, cylindracea apice rotundata, $5-10 \times 4-5\mu$. Thyriothecia dense dispersa, discreta vel saepe 2-3-connata, rotundata $120-130\mu$ diam., atra convexa; paries inferior ex hyphis dilute olivaceis vel griseis membranaceis radiantibus compositus; paries superior opace atrobrunneus ex hyphis radiantibus $4-5\mu$ crassis (cellulis $3-8\mu$ longis) compositus, 3-5-stellatim dehiscens usque ad marginem, segmentibus late triangularibus suberectis; margine fimbriatus, hyphis fimbriarum tortuoso-radiantibus usque ad 30μ longis exhyphopodiatis. Asci 4-8, globosi sessiles $25-30\mu$ diam., 4-8-sporei, paraphysati. Sporae conglobatae, opace atrobrunneae, oblongae utrinque rotundatae, 1-septatae, constrictae, $20-24 \times 10-11\mu$, cellula superiore leniter crassiore, episporio dense echinulato. Pycnidia thyriothecii consimilia; pycnosporae ovatae vel piriformes, castaneae leves $17-23 \times 12-15\mu$, poris germinationis 2-3 aequatorialibus.

Hab. in foliis *Dichapetali gelonioidis*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar* 900.

Colonies epiphyllous, thin black smooth rounded, up to 5 mm. diam., or often confluent over the leaf. Mycelium closely reticulate, of dark brown crooked hyphae $4-5\mu$ thick, the cells mostly $15-20\mu$ long, branching opposite or irregular. Hyphopodia continuous, alternate or unilateral, at wide angles, usually straight cylindric with rounded apex, $5-10 \times 4-5\mu$. Thyriothecia closely scattered or often 2-3-connate; when single rounded $120-130\mu$ diam., black; basal wall of radiating pale grey or pale olivaceous hyphae forming a membrane; upper wall opaque black brown, of closely compacted dark brown hyphae $4-5\mu$ thick, the cells $3-8\mu$ long, the margin

more or less fimbriate and the fringing hyphae tortuous-radiating, exhyphopodiate up to 30μ long, loose. Dehiscence by 3–5 stellate fractures extending to the margin, forming broadly triangular segments becoming more or less erect around the exposed layer of asci. Asci 6–8, globose, sessile, thin-walled, $25\text{--}30\mu$ diam., 4–8-spored, aparaphysate. Spores opaque dark brown, oblong with broadly rounded ends, 1-septate constricted, $20\text{--}24 \times 10\text{--}12\mu$, the upper cell slightly larger than the lower; episore closely echinulate. Pycnidia similar to the thyriothecia; pycnosporos ovate to piriform, chestnut-brown, smooth, $17\text{--}23 \times 12\text{--}15 \mu$, with 2–3 equatorial germ pores, but no hyaline band.

36. **Asterina Elaeagni** (Sydow) Sydow & Petrak in Ann. Mycol. **29**: 225. 1931.

FIGURE 35

On *Elaeagnus latifolia*, Balehonnur, Mysore, 20.8.1944, *Thirumalachar*.

Colonies epiphyllous, black, 0.5–1.0 mm. diam., with a close central group of thyriothecia. Mycelium of brown sinuous or crooked hyphae 3– 4μ thick, the cells mostly $30\text{--}50\mu$ long, branching irregular and forming a loose network. Hyphopodia scattered loosely, alternate or unilateral, brown, continuous, irregularly hemispheric to subglobose, entire, 6– 8μ diam. Thyriothecia densely grouped in centre of each colony, rounded, $120\text{--}160\mu$ diam., or confluent at the edges into irregular compound ascumata; lower wall indistinct; upper wall opaque brown, of radiating hyphae 3– 4μ thick, the cells 4– 8μ long, not fimbriate at the margin; dehiscence by stellate fissures with the central part falling away. Asci aparaphysate, subglobose 8-spored, sessile, about 30μ diam., 8-spored. Spores dark brown oblong, with rounded ends, smooth, 1-septate, constricted, $17\text{--}20 \times 8\text{--}9\mu$, the upper cell slightly larger than the lower; germinating by a hyphopodium formed at the septum.

37. **Asterina erysiphoides** Kalchbr. & Cooke in Grevillea **9**: 32. 1880.

FIGURE 36

On *Jasminum rigidum*, Nandi Hills, Mysore, 16.11.1944, *Thirumalachar*.

Colonies epiphyllous, rarely hypophyllous, black, thin, smooth, round, up to 3 mm. diam. Mycelium of dark brown substraight to slightly sinuous hyphae 5μ thick, the cells mostly $20\text{--}25\mu$ long, branching alternate or unilateral at $45\text{--}60^\circ$, loosely reticulate. Hyphopodia alternate or unilateral, concolorous, 1–(2)-septate, straight or irregularly bent, $13\text{--}22\mu$ long, 6– 12μ thick, both cells rather deeply sinuous-lobate, very irregular in shape and size. Thyriothecia scattered black convex, usually discrete and rounded, $90\text{--}130\mu$ diam., sometimes 2–3-connate into irregular compound ascumata, lower wall of grey-olive radiating hyphae 3– 3.5μ thick; upper wall of opaque dark brown radiating hyphae $4.5\text{--}5.5\mu$ thick, the cells $5\text{--}10\mu$ long, margin more or less fimbriate, the fringing hyphae often numerous, tortuous-radiating, paler than the mycelium, exhyphopodiate, up to 120μ long. Dehiscence by stellate fractures extending to the margin, the wall splitting into numerous narrowly triangular segments. Asci few, about 10,

apapophysate, embedded in yellowish mucus, subglobose sessile 8-spored, about 35μ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, constricted, $20-27 \times 11-14\mu$, the surface nearly smooth, the upper cell somewhat larger than the lower and subglobose.

38. *Asterina mysorensis* sp. nov.

FIGURE 37

Plagulae amphigenae atrae orbiculares leves, 2-3 mm. diam., subdensae, saepe confluentes. Mycelium ex hyphis atrobrunneis flexuosis $6-8\mu$ crassis (cellulis plerumque $20-30\mu$ longis) oppositae vel irregulariter ramosis ($45-90^\circ$) dense reticulatis compositum. Hyphopodia opposita vel alternata, continua, obtuse conoidea vel cylindracea, recta vel curvata, $10-15 \times 5-8\mu$. Thyriothechia dense dispersa, plerumque discreta, atra rotundata convexa, usque ad 130μ diam., paries inferior indistinctus; paries superior subopace atrobrunneus, ex hyphis radiantibus $6-7\mu$ crassis (cellulis $6-10\mu$ longis) compositus, margine haud vel leniter fimbriatus, irregulariter stellatim dehiscens. Asci 2-4, in ordine maturescentes, globosi sessiles, apapophysati, 8-sporei, $45-50\mu$ diam. Sporae conglobatae oblongae utrinque rotundatae, subopace atrobrunneae, 1-septatae constrictae $26-32 \times 14-17\mu$, episporio subtiliter denseque verruculoso.

Hab. in foliis *Fici* sp., Nandi Hills, Mysore, 18.10.1944, *Thirumalachar*.

Colonies amphigenous black orbicular smooth, 2-3 mm. diam., or confluent, dense in the centre. Mycelium of crooked dark brown hyphae $6-8\mu$ thick, the cells mostly $20-30\mu$ long, branching opposite or irregular at $45-90^\circ$, closely reticulate. Hyphopodia opposite or alternate, continuous, bluntly conoid to cylindric with obtuse rounded apex, straight or variously bent, $10-15 \times 5-8\mu$. Thyriothechia densely scattered, but usually discrete, black, circular, convex, up to 130μ diam.; lower wall indistinct; upper wall of subopaque dark brown radiating hyphae $6-7\mu$ thick, the cells $6-10\mu$ long; margin not or only slightly fimbriate; the centre dehiscent by irregularly stellate fissures and soon falling away to expose the asci. Asci 2-4, ripening in succession, globose 8-spored, apapophysate, sessile, $40-50\mu$ diam. Spores conglobate, oblong with rounded ends, subopaque dark brown, 1-septate constricted, $26-32 \times 14-17\mu$, the surface finely and closely verruculose.

39. *Cercospora capparidicola* sp. nov.

Maculae nullae; mycelium ex hyphis dilute brunneis $2-3\mu$ crassis, septatis flexuosis, irregulariter ramosis, ex stomatibus folii parce fasciculatis emergentibus, et supra epidermidem repentibus compositum. Conidiophora dispersa singulariter, erecta brunnea simplicia recta vel leniter flexuosa, $30-50\mu$ alt. et $4-7\mu$ cr., 3-5-septata, superne leniter geniculata. Conidia singula terminalia filiformia brunnea $10-20$ -septata, haud constricta, $60-150 \times 5-6\mu$, sursum gradatim attenuata, apice rotundata, basi hilo atropiano prominulo praedita; exosporio minute atro-granuloso.

Hab. in foliis *Capparidis sepiaariae*, Nandi, Mysore, 18.11.1944, *Thirumalachar*.

The fungus causes no definite leafpots, but forms a dark effuse thin mould over irregular patches of the lower surface of the leaf, consisting of the surface creeping hyphae, emergent in small fascicles through the stomata, and scattered single erect conidiophores. The surface mycelium consists of flexuous septate pale brown hyphae $2-3\mu$ thick, from which the conidiophores arise as erect branches, $30-50\mu$ high by $4-7\mu$ thick, 3-5-septate, brown, simple, straight or slightly flexuous, somewhat geniculate

above. The conidia are single and terminal on the conidiophore, filiform, brown, 10-20-septate, not constricted, $60-150 \times 5-6\mu$, gradually attenuated upwards to the rounded apex, and at the base with a flat black slightly projecting hilum; the surface is minutely dark granulose.

DEPARTMENT OF AGRICULTURE
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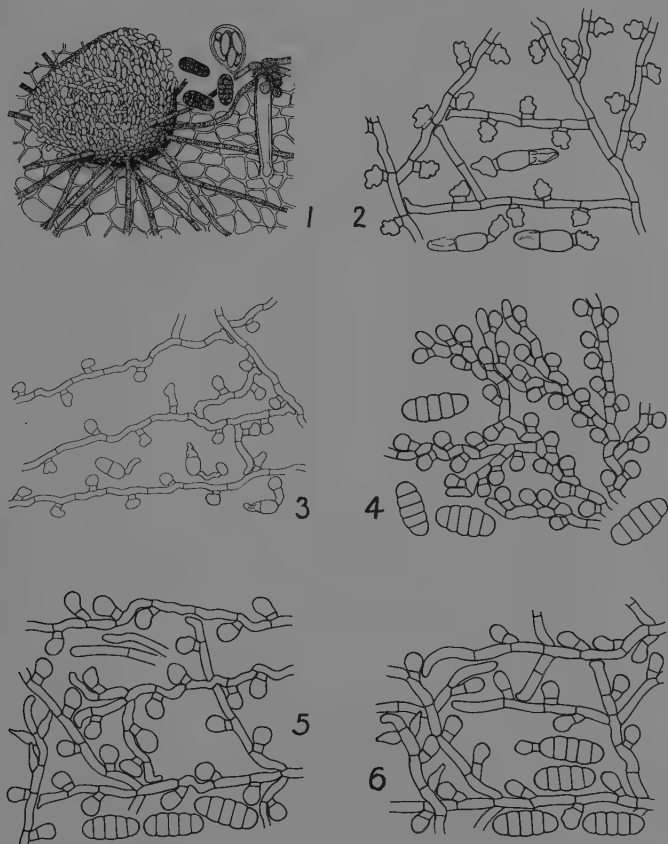


Fig. 1-6. All $\times 250$. 1, *Dictyonella Alangii*. 2, *Armatella Litseae*. 3, *A. Cinnamomi*. 4, *Amazonia Leeae*. 5, *Irenopsis mysorensis*. 6, *Irenina Pothodis*.

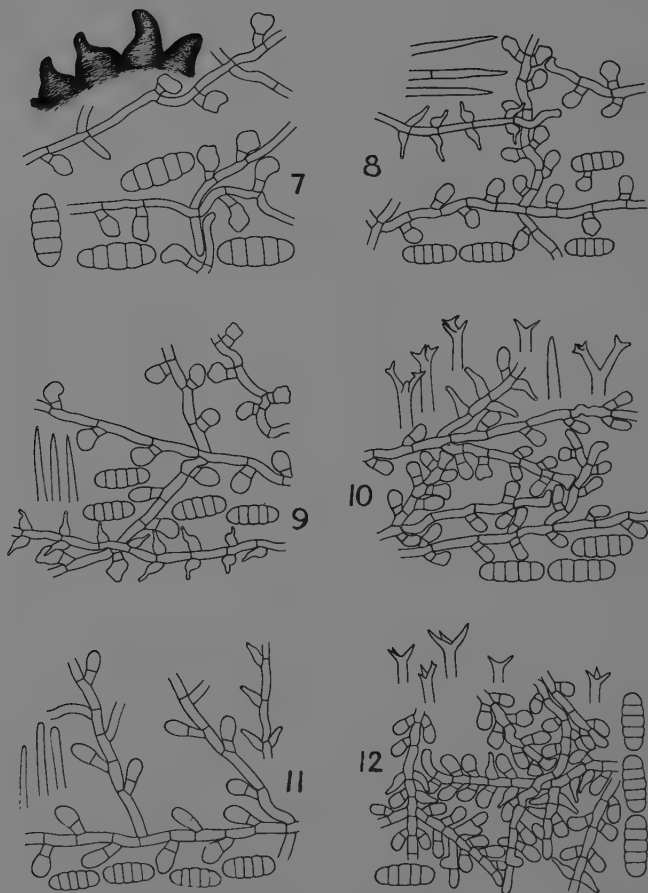


Fig. 7-12. All outlines $\times 250$. 7, *Irenina Malloti*. 8, *Meliola Bakeri*. 9, *M. bangalorensis*. 10, *M. Cansjerae*. 11, *M. cissampelicola*. 12, *M. Dichapetali*.

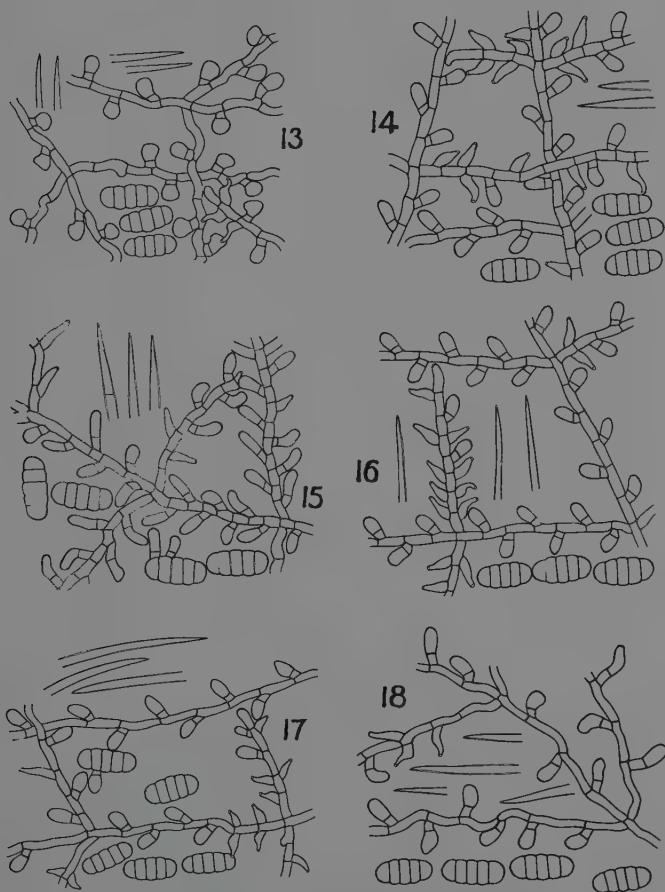


Fig. 13-18. All $\times 250$. 13, *Meliola Eleagni*. 14, *M. ficicola*. 15, *M. Gardneriae*. 16, *M. Heyneae*. 17, *M. Holarrheniae*. 18, *M. Ichnocarpi*.

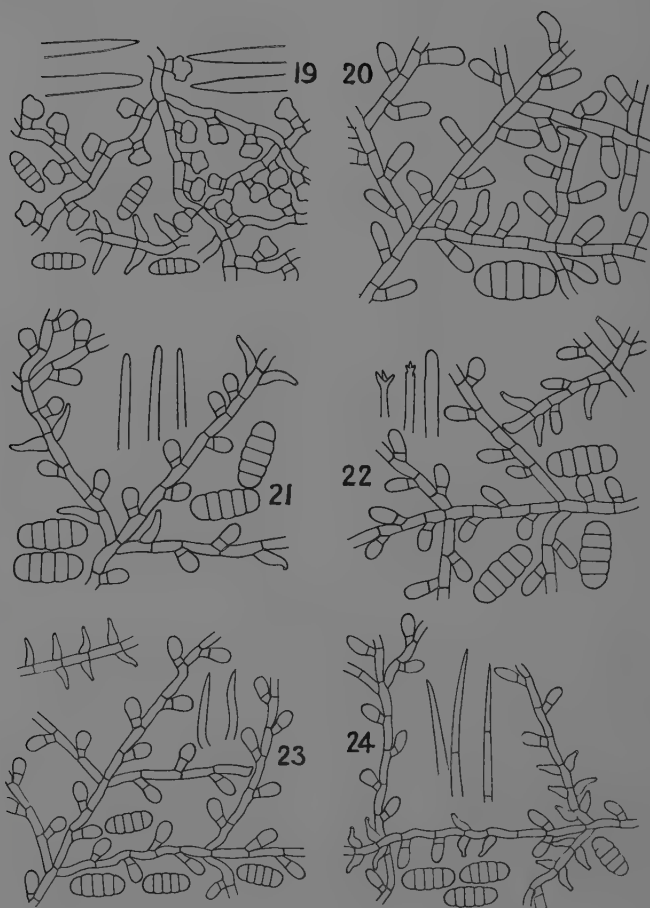


Fig. 19-24. All $\times 250$. 19, *Meliola Kydiae-calycinae*. 20, *M. Mangiferae*. 21-22, *M. Memecyli*. 23, *M. ovatipoda*. 24, *M. tabernaemontanicola*.

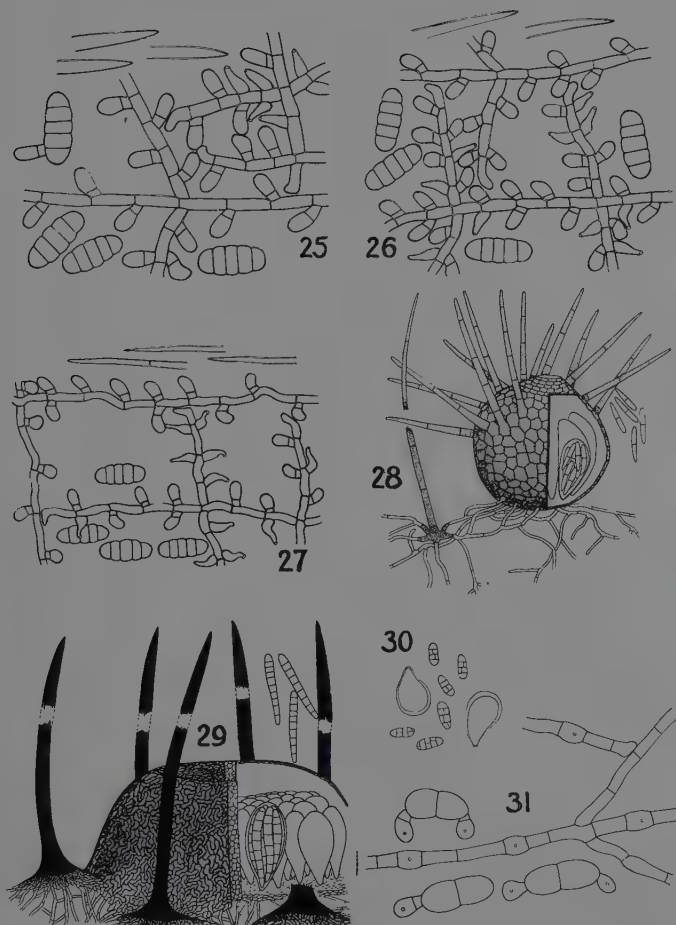


Fig. 25-31. All $\times 250$. 25, *Meliola Tecleae* var. *Toddaliae-asiaticae*. 26, *M. toddalicola* var. *indica*. 27, *M. Zizyphi*. 28, *Dimeriella Salaciae*. 29, *Chaetothyrium mysorensis*. 30, *Stephanotheca Oleae*. 31, *Asterolibertia Mangiferae*.

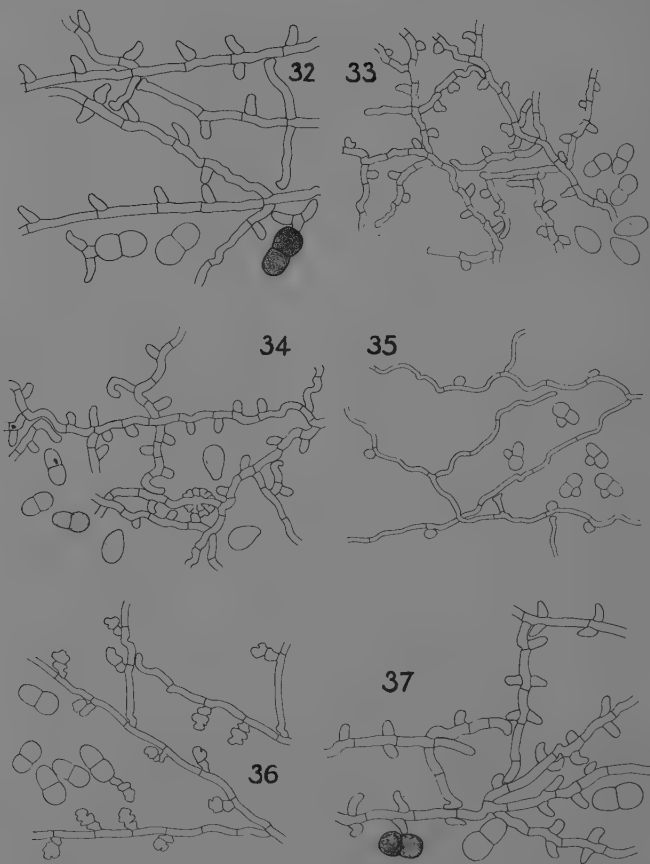


Fig. 32-37. All $\times 250$. 32, *Asterina cansjericola*. 33, *A. congesta*. 34, *A. Dichapetali*. 35, *A. Eleagni*. 36, *A. erysiphoides*. 37, *A. mysorensis*.

VARIABILITY AND PERITHECIUM PRODUCTION IN A HOMOTHALLIC FORM OF THE FUNGUS, *HYPOMYCES SOLANI*¹

SHUH-WEI HWANG

With the isolation in 1944 of a homothallic form of *Hypomyces solani* (Rke. et Berth) Snyder et Hansen from the stem of banana, *Musa paradisiaca* L. imported from Mexico, an opportunity was afforded to compare its variability with that of heterothallic forms of the same species which have been previously studied by others (4,6). This homothallic isolate, although apparently a saprophyte on the banana, has as its imperfect stage *Fusarium solani*, a species which contains both saprophytic and parasitic forms (8).

Ascosporic variants were obtained by Dimock (1, 2, 3, 4) from *Hypomyces ipomoeae* (Hals.) Wr. (*H. solani*) by hybridization and by culturing the organism in a medium which contained sublethal concentrations of zinc nitrate. Dimock's fungus was a heterothallic saprophyte obtained from sweet potato, *Ipomoea batatas* Lam., whereas that studied by Hansen and Snyder (6) was a heterothallic form parasitic on squash, *Cucurbita pepo* L.

CULTURAL CONDITIONS AND PROCEDURES

In an attempt to obtain uniform and genetically pure inoculum, the single spore isolation method of Hansen and Smith (5) was used. A dilute spore suspension was poured on a 3% plain agar plate and the excess water drained off. Over night, spores left on the plate put out one or more germ tubes of considerable length. Under the dissecting microscope, the germinating spore body was readily cut out with a sterilized steel needle and transplanted to a potato dextrose agar slant.

The method described above was applied to ascospore as well as to conidium transfers except that the ascospores were checked under the compound microscope before transplanting them from plate to tube. However, the preparation of ascospore suspensions required special technique. Spores for this purpose could be obtained in two different ways. The most convenient way was to lift off the accumulated spore mass at the ostiole of the perithecium with a pair of sterilized forceps or with a needle. The spore mass was then dispersed in the water blank. If a spore mass was not available at the mouth of the perithecium a perithecium was picked up from the culture medium, washed with a few changes of sterilized water to eliminate

¹ Portion of a thesis submitted to the Graduate Division, University of California, in partial satisfaction for the degree of Doctor of Philosophy, June, 1946. The writer gratefully acknowledges the advice and criticisms offered during the course of the investigation and in the preparation of the manuscript by Professor H. N. Hansen and Professor William C. Snyder.

conidia that might be adhering to the perithecial wall, and placed in a drop of water on a flamed slide. A blunt steel needle applied to the perithecium forced ascospores out from the ostiole or from the cracked wall of the perithecium. This small drop of spore suspension was washed off the slide on to a plain agar plate. The rest of the procedure from this point on follows that described above.

All of the tests were conducted under ordinary laboratory conditions unless otherwise mentioned. The cultures were so arranged on tables as to receive the maximum available indirect light during the day.

OCCURRENCE OF VARIANTS AND THEIR CHARACTERISTICS

Twenty monoasporic tube cultures were made by Dr. W. C. Snyder on potato dextrose agar from a single perithecium originally found on the banana stem. All of these monosporic cultures produced red, berry-like perithecia without requiring the introduction of conidia from a foreign compatible reaction culture and therefore were homothallic. The present studies began with one of these cultures.²

This original ascosporic isolate was designated the 'N' or Normal type. From it were obtained, subsequently, two types known respectively as the 'B' or Button type and 'E' or End type.

The differences between these 3 types (Plate 1) are in their gross cultural characteristics on potato dextrose agar, namely the habit and amount of mycelial growth, the pattern of the mycelial mat and the pigmentation of the cultures. These characteristics were so pronouncedly different in the 3 types, that these types could easily have been mistaken for entirely different organisms if one had not known their origin.

In some cases physiological differences were also shown. For example, some cultures produced perithecia and macrospores more readily than others. From the standpoint of cultural characteristics these 3 types remained separate and distinct, while under microscopic examination, the morphology of microspores, macrospores, chlamydo-spores, perithecia and ascospores on which classification is based showed no great diversity in all variants studied. Therefore the only conclusion that could be made concerning these variants was that they are manifestations of the genetic variability of a single organism.

The B type first appeared among a series of monosporic cultures of the N type. This occurred repeatedly. Further studies indicated that B either produced another type, E, which was culturally different or remained unchanged with minor modifications, namely with slight changes in pattern of the mycelial growth and in ability to produce spores and perithecia. The progenies of B therefore varied either in a direction further away from N or within the limits of the B type.

² An inoculation test conducted in the greenhouse demonstrated that this culture was not parasitic on squash and that it was distinct therefore from *H. solani* f. *cucurbitae*.

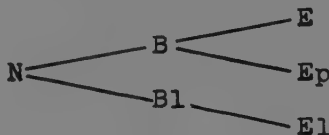


PLATE I

Comparative appearance and growth rates of 20 day old single-spore cultures, in duplicate, of *Hypomyces solani* (homothallic form) on potato dextrose agar. The types in the first chain mutation, N to B to E are represented, respectively, by A, B, and C; whereas those of the second chain mutation, B to B1 to E1 are shown, respectively, by D, E, and F.

All B types either came from N or from an already existing B and had the ability to produce the entirely different type E. One of the characteristics of E was that it no longer gave rise to variants. One B could give rise to 1 or 2 E types.

The phenomenon wherein N gave rise to B which in turn produced E is termed here a chain reaction. Two such chain reactions were revealed in the study and are illustrated in Text Figure 1.



TEXT FIGURE 1. Origin and direction of the chain mutations N to B to E, and N to B1 to E1.

Two complete reactions (Plate 1), first N to B to E and, second, B to B1 to E1 have been under close observation as outlined in the above diagram. The first series of variants was directly derived from N while the second series was from B. Minor variations within the limits of B occurred frequently, but once the fungus changed into the E type active variability ceased and it became stable. A purple modification of E, namely Ep, was occasionally obtained from B instead of the usual non-pigmented E.

1. *The normal type, N*

The so-called normal type was the original type. This was the cultural type isolated directly from nature. Its cultural characteristics differed from those of the other two types by its loose, silky, mycelial growth. Regardless of the age of the culture conspicuous conidial masses ordinarily did not appear on the mycelial mat except in one of the minor variations within N. Moderate growth of aerial mycelium resulted in a thin, smooth mat on solid medium, with a slightly grey-purple cast.

2. *The button type, B*

The prominent characteristic of the button type was its slow growth rate on potato dextrose agar and the general creamy appearance of the raised colony which suggested very much a yeast culture. Mycelial growth extended deeply into the medium and altered the texture of agar into a leathery consistency. A 5-day old culture was the size of a pea and had a smooth surface which became rough or wrinkled with age. After the colony reached the size of the diameter of the culture tube, it remained circular, hence the term 'button.' A mycelial sector or sectors sometimes appeared on the edge of the button. In this event, the rest of the agar slant soon became covered by mycelial growth, but the button still maintained its identity in the center of the colony. Altogether these characteristics were markedly different from those of the ordinary *Fusarium* culture, and from those of the N type from which it originated.

The majority of the cultures of this type were beige colored, at least when they were young. Violet and different degrees of purple appeared in a few cultures and some cultures gained in intensity of coloring as age advanced. Aside from pigmentation, the described characteristics of this button type were constant throughout the studies.

3. *The end type, E.*

The cultural characteristics of the E type were those commonly encountered in *Fusarium*. Comparatively speaking, all the variations of this type possessed thicker mycelial mats than did the normal type. In one of the subtypes, the aerial mycelium in older cultures formed a dense cotton-like layer, so thick and spongy as to provide a great capacity for water absorption. In another E type a purple pigment was present.

THE CHAIN MUTATION: N TO B TO E

1. *Mutation of N*

Monosporic cultures were made from normal (N) one and a half to three month old monosporic cultures. Among this series 5 out of 10 isolations from one tube and 2 out of 10 from another tube gave the B type. Details are given in Table 1.

TABLE 1. THE PROGENIES OBTAINED BY SINGLE SPORE TRANSFER FROM N CULTURES OF DIFFERENT AGES

Culture age in months	Spore kind	Progenies		Total transfers
		N	B	
1½	{ ascospore	15	14	14
	{ conidium			15
2	{ ascospore	5	18	18
	{ ascospore		20	20
	{ ascospore		14	14
	{ conidium		5	10
3	{ conidium	8	2	10
	{ ascospore		11	11
Total		28	84	112

From a normal culture, one and a half months old, the monoconidial isolations developed only into the normal type while the monoascosporic isolations resulted in the button type. Monoascosporic isolations made from a single perithecium of an N culture also yielded the B type. Sixteen perithecia of different cultures of various ages were included in this analysis. The majority of them gave the B type. However, these results did not mean that a conidial culture would always give the N type nor that the ascospore cultures would always give the B type, since younger cultures yielded mostly the N type irrespective of the kind of spore transferred. They merely indicated that this B type was obtainable either by monoconidial or monoascosporic isolations from aged N cultures.

Among these 112 monosporic cultures 25% or 26 cultures were N and 75% or 84 cultures developed into the B type. The ratio may or may not be significant of any natural law governing the appearance of this B type, yet it did strongly suggest that an entirely different culture character may evolve from an N type and that the frequency of its appearance was high and predictable.

2. *Mutation of B*

The mutation of B consistently gave E. The E type was apt to appear at any point in the margin of a B culture after it was 7 to 10 days old. This happened frequently and was recorded about 50 times or more in monosporic cultures of the B type.

The E type could also be isolated by the single spore method from B type cultures in which there was no sign of E. Often as high as 50% of the single spore sub-cultures from B were the pure E type. Therefore monoonidial and monosporic transfers from the B type fell into two distinct classes; either B or E. This is demonstrated by the following table.

TABLE 2. TYPES OBTAINED IN SINGLE SPORE SUB-CULTURES FROM B CULTURES

Culture age in months	Spore kind	Progenies		Total transfers
		B	E	
1	ascospore	6	0	12
	conidium	6	0	
1½	ascospore	0	3	6
	conidium	1	2	
	ascospore	0	3	6
	conidium	2	1	
	ascospore	0	3	6
	conidium	3	0	
2	ascospore	0	6	12
	conidium	6	0	
	conidium	3	0	3
	ascospore	1	2	6
2½	conidium	0	3	
	ascospore	0	3	6
	conidium	0	3	
	ascospore	0	3	6
	conidium	3	0	
Total		31	32	63

There was obtained from B a subtype of E designated as Ep which was stable and differed from E only in its production of a bright deep purple color in the agar.

3. *Constancy of E*

When E cultures were about one month old, monosporic cultures were made both from regions of the button proper and from the E sector in the

same tube. These monosporic cultures fell into two categories; either a button type or an end type. The results of this test are summarized in Table 3.

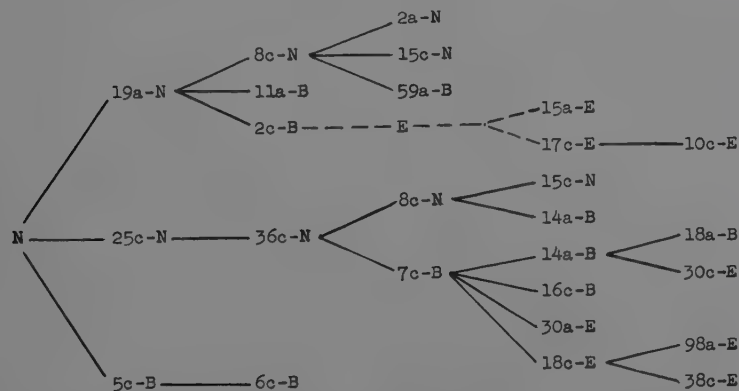
TABLE 3. SINGLE SPORE PROGENIES FROM A B CULTURE CONTAINING AN E SECTOR

Culture age in days	Spore kind	Progenies		Total transfers
		B	E	
24	conidium	14	14	28
24	"	17	6	23
25	"	8	7	15
42	ascospore	14	18	32
	conidium	16	16	32
Total		69	59	128

The perithecia under analysis here as well as the conidia were produced from the two distinctive regions of the same tube, yet the monoascosporic cultures gave about the same ratio of B and E cultures as did the monoconidial ones.

The white cotton-like E type was consistent from beginning to end throughout all the tests in being constant in its growing habits and culture characteristics on potato dextrose agar under the conditions reported here. This statement is illustrated by the fact that among a total of 183 monosporic cultures propagated both by single ascospores and single conidia from E cultures of different ages E was the sole type obtained.

The sequence of this first series of chain mutations and its products are shown in Text Figure 2. As the results indicate, mutations appeared among single ascospore as well as single conidium cultures.



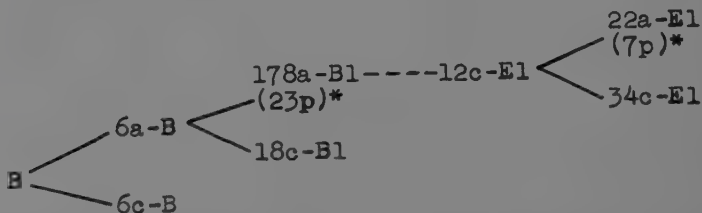
TEXT FIGURE 2. Sequence and number of mutations yielding B and E obtained from N by single spore transfers of conidia (c) and ascospores (a). The dotted line indicates that transfers were made from a sector.

THE CHAIN MUTATION: B TO B1 TO E1

In this second chain mutation, B1 differs from B in its heavy production of macrospores on the young culture. Also, later on, numerous red perithecia color the whole colony proper of B1 so abundantly that they give the culture a rusty appearance. The first appearance of B1 was found among monoascosporic cultures of B. An E1 variant was isolated by single spore sub-cultures which resembled B1 in the heavy production of macrospores and perithecia, but on account of its thick mycelial mat and its constancy was grouped with the E type. The aerial mycelium of E1 was not pure white but somewhat brownish and showed distinct concentric rings which E did not have. The essential difference between E and E1 was just the difference between B and B1, that is the excessive production of macrospores and perithecia, a condition which suggests a link between the E1 variant and original B1. It is also indicated that if variation occurred within the B limits, the variability continued to take place until an E type was produced.

The tests made on this series are summarized in Text Figure 3.

The incidence of the E1 type sector in a B1 culture was low in comparison to the incidence of the E sector in a B culture.



TEXT FIGURE 3. Sequence and number of mutations yielding B1 and E1 obtained from B by single spore transfers of conidia (c) and ascospores (a). The dotted line indicates that transfers were made from a sector of B1. The asterisk (*) indicates the number of perithecia under examination.

INFLUENCE OF FLOODING OR SPRAYING CULTURES ON PERITHECIUM FORMATION AND HYBRIDIZATION

That hybridization in a homothallic fungus such as *H. solani* is possible has been reported by Hwang et al. (7) who showed that E1 could be recovered by monoascosporic transfer from perithecia of N after N cultures had been flooded or sprayed with a spore suspension of E1. Not only have these results demonstrated that E1 was a true mutation but that this procedure offers an additional tool for the study of the genetics and inheritance within homothallic ascomycetes of this kind. It was also shown that perithecium production could be increased by flooding or spraying full grown cultures with sterile water.

EFFECT OF LIGHT ON PERITHECIUM PRODUCTION

That light favors perithecium production in some ascomycetes has been shown for the heterothallic parasitic fungus *H. solani* f. *cucurbitae* (9). Experimental results show that this is also true for the homothallic saprophyte, *H. solani*. Two sets each of test tube cultures of B and B1 were prepared. One set was kept in the dark, but placed side by side with the other set on a laboratory table. B1 and B were chosen because they possess contrasting abilities for perithecium production.

In the set subjected to light, perithecia appeared after 20 days in cultures of B1, and no perithecia had formed in B cultures. However, a month later a few perithecia were present in the B cultures, and the B1 slants were heavily covered with red fruiting bodies. Nothing had showed up on either B or B1 cultures in the dark. However, one week after the culture tubes in the dark were exposed to light, perithecia developed on both B and B1. A few appeared in cultures of the former type and large numbers in those of the latter. This shows that light is one of the factors necessary for the initiation and maturation of perithecia.

FRUCTIFICATION ON POTATO DEXTROSE MEDIUM

Observations were made on the relative abundance of the conidial and perithecial stages in cultures of the N, B, B1 and E type on potato dextrose agar after periods of 1, 2 and 6 weeks. All cultures were exposed to light during these periods. A summation of the results are as follows.

Microconidium production in the N type was more abundant than that of either macrospores or perithecia. Perithecium production was as weak as in B, which was poor in all kinds of sporulation. Macrospores were more plentiful in N than in B. The variant B1 obtained from B showed extraordinarily high productive ability for macrospores and perithecia. Microconidium production in E1, which was derived from B1, was as vigorous as in B1. If the members of the first chain reaction are compared by themselves then E has greater sporulating power than either N or B in respect to all three different kinds of fructifications.

AGING AND VARIATION

Cultures used in this study were a single tube each of N, B, and E. Conidia for single spore transfer were removed from one of four spots equidistant from the initial inoculum on these slants at intervals of one month by a moistened sterilized wire loop. However, owing to the low ability of B to sporulate, 4 tubes of it were prepared at the same time at the beginning of the experiment. In order to secure sufficient spores for spore suspensions a whole slant of B was washed with a water blank each month.

The outstanding fact shown in Table 4 is the constancy of E, when tested under different environmental conditions at various ages. But the incidence of variation in B was shown to decline with age while it increased in N.

TABLE 4. INCIDENCE OF MUTATION IN CULTURES OF N, B, AND E AS DETERMINED BY MONOCONIDIAL TRANSFERS MADE FROM CULTURES 1, 2, 3, AND 4 MONTHS OF AGE

Culture age in months	Progenies of N				Progenies of B				Progenies of E			
	N	B	Total	%	B	E	Total	%	E	other	total	%
1	18	5	23	21.7	16	5	21	23.8	22	0	22	0
2	25	0	25	0	8	15	23	65.2	24	0	24	0
3	5	17	22	77.3	26	0	26	0	31	0	31	0
4	4	18	22	81.8	21	0	21	0	22	0	22	0
Total			92				91				99	

DISCUSSION AND CONCLUSIONS

The high frequency of the appearance of variant B from N indicates that this variation is not a fortuitous incident but is a change to which the organism is predisposed. This is also true for the shift from B to E. However, the E type appears to be stable and once the organism has changed to this type it remains constant at least under the environmental conditions provided in these experiments.

Although the types described here have resulted from true mutations, there is no way to decide whether the two steps of the chain mutation N to B and B to E are changes in the same part of the genetic system or a sequence in which the change of the first induces the change of the second in a different part of the genetic system. As cytogenetic studies were not undertaken, the factors and their locations in chromosomes which might govern the cultural characteristics dealt with in this paper have not been determined.

Dimock (3) explained that the cause of the mutation that he observed in the heterothallic, saprophytic form of *H. ipomoeae* (*H. solani*) was in the nature of inactivation or alteration, rather than deletion or gene mutation since he reports that reversion from mutants to the normal type was high. If his interpretation is correct then the nature of the mutation occurring in the homothallic form is one of deletion or gene mutation rather than the inactivation or alteration of genes, because reversion has never been observed in this homothallic form of *Hypomyces*.

A comparison of the first mutation series, N to B to E, with the second series B to B1 to E1 reveals differences only in respect to quantity production of spores and perithecia. However, the first series came from N while the second series came from B or the first series. Since reversion was observed neither in the first nor second series the explanation of the nature of mutation in the first series could be applied also to the second series. Although mutation in the second series involves sporulation rather than the cultural characteristics, yet the chain mutation observed in these studies remains constant and the direction of the reaction is not disturbed.

The characteristics of the variants studied in this paper survived through the sexual stage. This fact in addition to successful hybridization is further proof that true mutations took place. Any types that were obtained from

monoconidial isolations were also obtainable from monoascospore isolations from the same culture. But because asexual multiplication precedes sexual reproduction, there is a strong indication that the mutations studied here take place at any time in any part of the gametophyte. This view is contrary to Dimock's belief (3) that in the heterothallic form of *H. solani*, gene mutation is favored in the maturation division particularly in heterozygotes. One disadvantage of using a homothallic organism in studying variation is that it is not easy to test the unit character of the individual variants by back crossing. However, in the present studies the E type was definitely obtainable after back crossing with N, so this objection is eliminated.

The fact that all mutants except B have a greater capacity to produce spores and perithecia than the N type suggests the possibility that some variant strains might be able to compete successfully with normal strains if they were given a chance to become established in nature. However, these mutants were derived only from B which had low sporulation ability and which therefore might not be able successfully to compete with the normal type under field conditions.

SUMMARY

An analysis is made of the variability of a homothallic form of *H. solani* by use of the single spore culture method.

Two principal variants appeared, the B or Button and E or End types. Variations within these types were also observed, such as B1 and E1, but the E types remained constant.

The variants obtained by monoconidium and monoascospore cultures were predictable and occurred with high frequency, always in the sequence N to B to E, or B to B1 to E1. No reversions in type occurred.

The evidence indicates that the variations obtained were due to gene mutations or deletions, since all variants were passed unchanged through the sexual stage, and since a successful cross between N and E has been effected.

Tests were conducted to determine the effect of light on perithecium production and aging upon the incidence of variation.

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LITERATURE CITED

1. **Dimock, A. W.** Variation in a species of *Fusarium* induced by high concentrations of zinc salts. *Cent. fur Bakt. II. Abt.* **95**: 341-347. 1936.
2. ———. Hybridization studies on a zinc-induced variant of *Hypomyces ipomoeae*. *Mycologia* **29**: 273-285. 1937.
3. ———. Hybridization experiments with natural variants of *Hypomyces ipomoeae*. *Bull. Torrey Bot. Club* **64**: 499-507. 1937.
4. ———. Studies on ascospore variants of *Hypomyces ipomoeae*. *Mycologia* **31**: 709-727. 1939.

5. **Hansen, H. N., & R. E. Smith.** The mechanism of variation in imperfect fungi: *Botrytis cinerea*. *Phytopath.* **22**: 953-964. 1932.
6. **Hansen, H. N., & W. C. Snyder.** The dual phenomenon and sex in *Hypomyces solani* f. *cucurbitae*. *Amer. Jour. Bot.* **30**: 419-22. 1943.
7. **Hwang, Shuh-Wei, H. N. Hansen, & William C. Snyder.** Increased perithecium formation and hybridization in flooded cultures of a homothallic ascomycete. *Mycologia* **39**: 196-199. 1947.
8. **Snyder, William C., & H. N. Hansen.** The species concept in *Fusarium* with reference to section *Martiella*. *Amer. Jour. Bot.* **29**: 738-742. 1941.
9. ————. The effect of light on taxonomic characters in *Fusarium*. *Mycologia* **33**: 580-591. 1941.

PROPOSED DATES FOR T. F. ALLEN'S EXSICCATAE (CHARACEAE)

R. D. WOOD¹

Two sets of exsiccatae of Characeae were issued by Timothy Field Allen between the years of 1880 and 1898: the *Characeae Americanae Exsiccatae* and the *Characeae Japonicae Exsiccatae*. The material in these sets includes certain specimens which are accompanied by labels bearing the only published descriptions of certain *nomina nova*. In order to determine the dates of publication for these new names, it is necessary that specific dates for the exsiccatae be determined or established.

The author made a search of the literature, and with but the few exceptions listed below, found no references to the issuance of the exsiccatae. An effort was made to obtain some facts from the files of various herbaria, particularly the New York Botanical Garden where Allen studied. Further search for information in the existing private files of botanists contemporary with Allen, including those of W. A. Setchell (University of California, Berkeley) and W. G. Farlow (Farlow Herbarium, Harvard University), disclosed no additional information. It is apparently necessary arbitrarily to select the dates best substantiated by the available information, and propose that they be accepted in the future as dates of publication of the exsiccatae and the *nomina nova* concerned.

The dates for fascicles I and II of the *Characeae Americanae Exsiccatae* have become established in the literature as 1880, and were cited as such by Robinson (1906) and Tilden (1895). The remaining three fascicles have remained undated as far as is known to the writer. As the last specimens of fascicle IV do not bear collection or determination dates, the author proposes that Allen's published announcement that these fascicles had been issued (Allen, 1888, p. 6) be accepted as sufficient evidence for establishment of 1888 for fascicles III and IV. The reasonableness of this date is further substantiated by the range of collection dates which appear on some of the labels in both fascicles. Most of the specimens in fascicle V are also undated, and it is proposed that the date of publication of the description of *Chara gymnophytis* var. *keukensis* Allen (1893, p. 120) for the last specimen (No. 46) in the set be accepted as sufficient evidence for establishing 1893 for this fascicle. Thus, in citation, it is proposed that the exsiccatae set be cited as *Characeae Americanae Exsiccatae* (1880-1893).

The *Characeae Japonicae Exsiccatae* were issued in two parts, for the most part without collection or determination dates. The first portion

¹The writer is especially indebted to Dr. R. M. Whelden and Miss Hilda Harris of the Farlow Herbarium, Harvard University; to Dr. G. F. Papenfuss of the Department of Botany, University of California, Berkeley; to Miss Rosalie Weikert of the New York Botanical Garden; and to many others for help during the search for more definite information on Allen's exsiccatae.

included specimens 1-17. It is proposed that this portion be known as *fascicle I*. The second portion of the exsiccatae was issued without dates or numbers, and included fourteen specimens. Whether this portion was issued by Allen himself, or distributed later as duplicates from his collections, is apparently not known; however, as the specimens have been distributed under the name of this set, the writer proposes that it be considered as *fascicle II*. Thus, the *Characeae Japonicae Exsiccatae* is construed to consist of two parts: fascicle I, to include specimens numbered 1-17; and fascicle II, to include the fourteen unnumbered specimens (as listed below). It is further proposed that Allen's announcement (Allen, 1895, p. 71) that the set (fasc. I) had been issued, be accepted as sufficient evidence for establishing the date of 1895. It is also proposed that the date of publication of the most recent description of the new species contained in fascicle II (Allen, 1898, p. 74) be accepted as sufficient evidence to establish 1898 as the date of issuance of fascicle II. Thus, in citation, it is proposed that the exsiccatae be cited as *Characeae Japonicae Exsiccatae* (1895-1898).

In summary, Allen's exsiccatae and the proposed dates and terms are listed below:

Characeae Americanae Exsiccatae (1880-1893).

Fasc. I. Nos. 1-10. 1880. Established.

Fasc. II. Nos. 11-20. 1880. Established.

Fasc. III. Nos. 21-30. 1888. *Proposed*.

Fasc. IV. Nos. 31-40a. 1888. *Proposed*.

Fasc. V. Nos. 41-46. 1893. *Proposed*.

Characeae Japonicae Exsiccatae (1895-1898).

Fasc. I. (*Proposed*). Nos. 1-17. 1895. *Proposed*.

Fasc. II. (*Proposed*). 14 unnumbered specimens. 1898. *Proposed*.

As the lists of exsiccatae specimens published by Allen were not completed, the additions are appended below:

Characeae Americanae Exsiccatae Fasc. V (1893).

To be added to the list published by Allen (1888, p. 6), which included fascicles I-IV. Together they form the complete list for this exsiccata set.

41. *Nitella flexilis* Ag. f. *subnidifica*.

42. *N. Bastini* Allen.

43. *N. Blankinshipii* Allen.

44. *N. formosa* Allen.

45. *N.² Hydropitys* A. Br. var. *mexicana* Allen.

46. *Chara gymnopitys* A. Br. var. *keukensis* Allen.

Characeae Japonicae Exsiccatae Fasc. II (1898).

To be added to the list published by Allen (1895, p. 71), which included fascicle I. As the following fourteen specimens were unnumbered, the writer has assigned provisional numbers to each for convenience in citing. These follow No. 17, the last specimen of fascicle I.

² *Nitella* should read *Chara*. In most of the sets seen by the author, *Chara* has been written over *Nitella* in ink, perhaps by Allen.

- (18). *N. capitulifera* Allen.
- (19). *N. capitulifera* Allen.
- (20). *N. expansa* Allen.
- (21). *N. gracillima* Allen.
- (22). *N. laxa* Allen.
- (23). *N. laxa* Allen.
- (24). *N. multipartita* Allen.
- (25). *N. multipartita* var. *suberecta* Allen.
- (26). *N. multipartita* var. *transiliiformis* Allen.
- (27). *N. multipartita* var. *intermedia* Allen.
- (28). *N. pseudoflabellata* A. Br. var. *imperialis* ³ Allen.
- (29). *N. rigida* Allen.
- (30). *N. Saito-iana* ⁴ Allen.
- (31). *N. Tanakiana* Allen.

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LITERATURE CITED

- Allen, T. F.** 1888. *The Characeae of America*, Part I. New York.
 ———. 1893. Notes on new Characeae. *Bull. Torrey Bot. Club* **20**: 119–120.
 ———. 1895. Japanese Characeae II. *Bull. Torrey Bot. Club* **22**: 68–71.
 ———. 1898. Contributions to Japanese Characeae III. *Bull. Torrey Bot. Club* **25**: 73–82.
Robinson, C. B. 1906. The Chareae of North America. *Bull. N. Y. Bot. Gard.* **4**: 244–308.
Tilden, Josephine E. 1895. XXIII. A contribution to the bibliography of American Algae. *Minn. Bot. Studies* **1**: 295–421.

³ "Var. *imperialis*" was apparently written on all labels which accompanied specimens of this variety, by Allen.

⁴ This name appeared as "*Saitoiana*", without the hyphen, in the original description (Allen, 1898, p. 73).

A REVIEW OF THE GENUS *NITELLA* (CHARACEAE) OF NORTH AMERICA^{1, 2}

R. D. WOOD

INTRODUCTION

OBJECTIVE

In the past four decades, the taxonomy of the Characeae in North America has been noticeably neglected. Although many physiological studies have employed *Nitella* for experimental material, little attempt has been made to state the species under observation. Similarly, relatively few algological studies or cryptogamic floras have included members of this family. The writer is of the opinion that much of this neglect is due to the unavailability of integrative information. Though there is little doubt that the primary need is a monograph on the group, the mass of material to be studied is so vast that taxonomists dealing in this field will be engaged for some time before such a work can be completed. Robinson (1906) assembled the information on the genus *Chara* in his "The Chareae of North America." On the other hand, no single work covers the genus *Nitella* for North America.

The present paper represents a compilation of the published information on the genus *Nitella*. It is recognized that this represents but one necessary phase in the over-all objective, and as such is offered with reluctance by the writer. However, it was felt by his associates that, in light of the absence of any comparable source of information, the presentation of this paper was both timely and needed. It has been the writer's aim to assemble data on the local flora, review the literature to date, and bring the nomenclature in accord with the existing rules. It is emphasized that the writer has endeavored to report only published data, and to eliminate as far as possible his own opinions on the taxonomy of the Characeae.

BACKGROUND

Linnaeus (1753) originally delimited the genus *Chara* with four species. Agardh (1824) established the genus *Nitella* with twelve species, including the transfer of one of the Linnaean Charas (*Chara flexilis* L. = *Nitella flexilis* (L.) Ag.) to the new genus. Braun (1849: 195, 292) redefined *Nitella*, after contesting its validity for many years, emphasizing as a distinctive feature the coronular structure rather than the presence or absence of cortication. Leonhardi (1863: 72) established a third genus, *Tolypella*,

¹ Adapted from original Doctoral dissertation, "A Floristic Contribution on *Nitella* (Characeae) in the United States" (Northwestern University).

² North America for the present paper is delimited to include the continent north of Panama, exclusive of the West Indies and Greenland.

to be coordinate with *Nitella*. This same author had originally considered the status of *Tolypella* to be subgeneric.

The family Characeae (Richard in Humboldt and Bonpland, 1815: 38), sometimes ranked as a class or phylum, is considered in this paper to consist of two subfamilies or tribes: Chareae (Leonhardi, 1863: 72) with the genera *Chara*, *Lychnothamnus*,³ *Lamprothamnium*,³ and *Nitellopsis*;³ and Nitelleae (Ganterer, 1847: 8, *pro parte, em.* Leonhardi, 1863: 69) with the genera *Nitella* and *Tolypella*.

The genus *Nitella*, as delimited in recent works and for the present paper, includes the Charophyte plants in which the coronula of the oogonium is composed of ten cells in two tiers, branchlets usually are furcate, ripe oospores are laterally compressed, and antheridia are apical in the furcations of the branchlets above the oogonia.

The Nitellae form a rather closely knit homogeneous group within the Characeae. The plant generally originates as a lateral sprout from a prothallus formed from germination of the oospore. Hyaline rhizoids penetrate the substrate, and the green plant grows upward into the water medium of its habitat. The primary axis consists of alternating nodal and internodal cells, with a whorl of branchlets (laterals of limited growth) being formed by lateral apical cells at each node. The branchlets divide successively one to four (or five) times into two to four (or five) rays at the branchlet nodes, the ultimate rays forming dactyls. Sex organs are usually borne at the branchlet nodes. The antheridium replaces the apical cell at a branchlet furcation. The oogonium replaces a ray, and occurs laterally at the node. The taxonomy of this group has been based largely upon the variations of these factors.⁴ About one hundred and fifty species of *Nitella* have been treated in the literature for the world, with a great number of subspecific entities. Of this number, many have been reduced to synonyms.

LITERATURE

The literature bearing directly upon the species of *Nitella* in North America stems in part from European works, generally as minor considerations of larger studies. Braun (1883) reported the following species for North America:

- | | |
|--|---|
| 1. <i>N. acuminata</i> | 6. <i>N. clavata</i> |
| subsp. <i>glomerulifera</i> | var. <i>inflata</i> (Mexico) |
| var. <i>Lindheimeri</i> | 7. <i>N. flexilis</i> |
| var. <i>subglomerata</i> | 8. <i>N. gracilis</i> |
| var. <i>subglomerata</i> f. <i>brachytelea</i> | 9. <i>N. hyalina</i> var. <i>Engelmanni</i> |
| 2. <i>N. Asagrayana</i> (Mexico) | 10. <i>N. intermedia</i> |
| 3. <i>N. axillaris</i> | 11. <i>N. microcarpa</i> |
| 4. <i>N. capillata</i> | var. <i>Drummondii</i> |
| 5. <i>N. capitellata</i> | subsp. <i>megacarpa</i> |

³ These genera have not been recorded for North America.

⁴ Allen, T. F., and certain other workers have also employed variations in oospore membrane patterns and size to differentiate new species.

- | | |
|--------------------------------|---|
| 12. <i>N. mucronata</i> | 13. <i>N. oligospira</i> var. <i>Wrightii</i> |
| var. <i>leiopyrena</i> | 14. <i>N. opaca</i> |
| var. <i>pachygyra</i> | 15. <i>N. praelonga</i> |
| subsp. <i>virgata</i> | 16. <i>N. pygmaea</i> (Mexico) |
| f. <i>robustior longifurca</i> | 17. <i>N. tenuissima</i> |
| f. <i>tenuior</i> | var. <i>compacta</i> |

The works of Nordstedt (1889), Groves, H. and J. (1911), and Zaneveld (1940) have contributed to the knowledge of the genus in North America mainly in critical reviews of new forms.

Halsted (1879) was the first American author to attempt a monographic treatment of the Characeae of the New World, and six species of *Nitella* were treated, including a new variety (*N. gelatinosa* var. *gigantea* Halsted = *N. praelonga* Braun). Woods (1894) assembled the information on the Characeae of Nebraska, and treated five *Nitellas*. Most of our knowledge of the American species of *Nitella*, as well as Characeae in general, is the result of the indefatigable labor of Allen. During the period of his active publishing on Characeae (1871-1901), he described thirty-four new species of *Nitella*, of which fourteen were described for the United States and twenty for North America. The new forms described by Allen for North America are as follows:

- | | |
|--|---|
| 1. <i>N. annularis</i> (Mexico) | 11. <i>N. minuta</i> (New Jersey) |
| 2. <i>N. Bastini</i> (Chicago, Illinois) | 12. <i>N. missouriensis</i> (Missouri) |
| 3. <i>N. Blankinshipii</i> (Missouri) | 13. <i>N. montana</i> (Montana) |
| 4. <i>N. californica</i> (California) | 14. <i>N. Morongii</i> (Nantucket) |
| f. <i>nidifica</i> (California) | 15. <i>N. obtusa</i> (Canada) |
| 5. <i>N. dilatata</i> (New Brunswick) | 16. <i>N. occidentalis</i> (California) |
| 6. <i>N. formosa</i> (Mexico) | 17. <i>N. stellaris</i> (Western U.S.A.) |
| 7. <i>N. Leibergii</i> (Oregon) | 18. <i>N. subspicata</i> (Missouri) |
| 8. <i>N. Macounii</i> (Lake St. Clair, U.S.A.) | 19. <i>N. temiscouatae</i> (Montana) (<i>nomen nudum</i>) |
| (?)) | 20. <i>N. transilis</i> (Massachusetts) |
| 9. <i>N. megacarpa</i> (Connecticut) | |
| 10. <i>N. mexicana</i> (Mexico) | |

A number of other entities were treated in an ambiguous manner or assigned names without accompanying descriptions. Unfortunately, Allen's chief contribution on the *Nitellae*, *The Characeae of America*, Part II (1892, 1894, 1896), was completed only to include the monarthrodactylae group of the *Nitellae*, and so left a significant portion of the species untreated. A large number of floristic works have contributed distributional data on various species for the region; but, since the time of Allen, no attempt has been made to compile the information known on the species of *Nitella*.

NOTES

The plan adopted for the present paper is the usual pattern employed for floristic works. Each legitimate species, subspecies, variety, or form which has been reported for the region is described in detail or disposed of as a synonym in accordance with reports of later studies. Distribution records, exclusive of exsiccatae, are listed by countries and states. The type

localities indicated are based purely on the specimens cited in the original descriptions, and precise indications of types must await monographic treatment. The synonymies list only the critical references which bear directly upon the name employed, and the reader is referred to Groves and Bullock-Webster (1920; 1924),⁵ Migula (1897),⁶ and Zaneveld (1940)⁷ for more complete synonymy. The literature which records species for North America is listed for each form. A review of the facts bearing upon the nomenclature is given in detail. Exsiccatae listed include only the specimens collected in the region. Where no exsiccatae have been issued for a given form, the writer has attempted to cite specimens and indicate certain herbaria in which they are deposited. Names of herbaria are abbreviated in accordance with Lanjouw (1939).⁸ The bibliography includes the literature cited and the references which treat Characeae for North America. The reader is referred again to Groves and Bullock-Webster, Migula, and Zaneveld for more exhaustive lists.

Certain of the works of T. F. Allen cause difficulty in abbreviation of titles. The writer has indicated these various works as follows:

Characeae Americanae, Parts 1 and 2. 1879 — Char. Amer. **1, 2.** 1879.

The Characeae of America, Parts 1 and 2. 1880 — Char. Amer. **1,2.** 1880.

The Characeae of America,

Part 1. 1888 — Char. Amer. **1.** 1888.

Part 2, Fasc. 1. 1892 — Char. Amer. **2(1).** 1892.

Fasc. 2. 1894 — Char. Amer. **2(2).** 1894.

Fasc. 3. 1896 — Char. Amer. **2(3).** 1896.

Characeae Americanae Exsiccatae, Fasc. I-V. 1880-1893 — Char. Amer. Exsicc. 1880-1893.

The three fascicles of Allen's (1892, '94, '96) "The Characeae of America" include a series of plates which were issued loose and without numbers. For this reason, various libraries have assembled and numbered the plates in different manners. Therefore, the writer has arbitrarily adopted the plan of assigning numbers to each plate corresponding to the sequence of names that appear in the tables of contents for the three fascicles. In case more than one plate appears for a given species, the number is assigned to the lithograph, and letters — a, b, c, d — are assigned to the photogravures in order as they are mentioned in the explanation of the plates in the text. This order very closely approximates the numbering which appears in the volume in the library of Oberlin College (589.58) except for 25, 26, and 27 which are numbered 24, 25, and 26, respectively, because both *N. minuta* and *N. pygmaea* appear on one page. The plate numbers proposed are as follows:

Fasc. 1: — 1, 1a. *opaca* — 2, 2a. *obtusa* — 3. *montana* — 4. *Blankinshipii* — 5, 5a. *missouriensis* — 6, 6a, 6b. *flexilis* — 7, 7a. *subglome-*

⁵ British Charophyta, **1** (1920), **2** (1924). London.

⁶ In Rabenhorst, Krypt.-Fl. Deutschl. Oesterr. und der Schweiz. ed. 2: **5.** 1897.

⁷ Blumea **4.** 1940.

⁸ Chron. Bot. **5:** 142-150. 1939.

rata — 8. *glomerulifera*; **Fasc. 2:** — 9. *capitata* — 10. *Bastini* — 11. *praelonga* — 12. *clavata* — 13. *dilitata* — 14. *Macounii* — 15. *axillaris* — 16. *Morongii* — 17. *annularis*; **Fasc. 3:** — 18. *Leibergi* — 19. *mucronata* — 20. *capitellata* — 21. *gracilis* — 22. *tenuissima* — 23. *transilis* — 24. *pygmaea* — 25. *minuta* — 26. *intermedia* — 27. *Asagrayana*.

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A posthumous debt of gratitude is due Charles Budd Robinson, whose excellent notes on the genus *Nitella*, found by the writer in the herbarium of the New York Botanical Garden, afforded another worker's data against which the present manuscript was checked.

THE KEY

The following key is analytical in nature and represents the writer's attempt to organize the legitimate local forms into a workable scheme based upon data given in the descriptions. The classical synopsis categories of Nordstedt and Allen, i.e., brachydactylae and macrodactylae, have been by-passed in favor of what seem to be combinations of more satisfactory characters. The cases where dichotomies are based on weak distinctions reflect both the need of revision in the group and the high degree of polymorphism inherent in certain forms. The numbers preceding the species names indicate the sequence of species in the text as well as in the key. Although a concerted attempt has been made to employ vegetative characters, it has been necessary to use every available bit of information in attempting a separation of many species. For this reason, one will generally be obliged to have complete plant material with mature sex organs.

- 1a. Dactyls strictly 1 celled⁹ (2)
- 1b. Dactyls more than 1 celled (22)
- 2a. At least some of the branchlets more than once divided (2-3 times in fertile branchlets) **1. N. Macounii**
- 2b. Branchlets simple or once divided (3)
- 3a. Branchlets in fertile whorls consisting of 2 different types, some divided and others not divided **2. N. clavata**
- 3b. Branchlets in fertile whorls not of 2 different types (4)
- 4a. Dactyls abruptly pointed, obtuse or acute — not acuminate (5)
- 4b. Dactyls gradually tapering to an acuminate point (14)
- 5a. Antheridia 130 μ in diameter; oospore membrane marked with squared or elongated elevations; oospores 210-215 μ long (1. *N. Macounii*)
- 5b. Antheridia 245-775 μ in diameter; oospore membrane not marked with squared elevations; oospores 260-600 μ long (6)
- 6a. Upper coronular cells of oogonia greatly elongated; oospore membrane perfectly smooth **3. N. dilatata**
- 6b. Upper coronular cells not elongated; oospore membrane varying (7)
- 7a. Fertile branchlets progressively shortened, forming a long terminal "inflorescence"; dioecious **4. N. obtusa**
- 7b. Fertile branchlets not forming a long terminal "inflorescence"; monoecious or dioecious (8)
- 8a. Antheridia 500-775 μ in diameter; oospore membrane smooth to warty¹⁰ (11)
- 8b. Antheridia 245-360 μ in diameter; oospore membrane granular or grumous (9)
- 9a. Antheridia 245-285 μ in diameter; oospore membrane granular; oospores 275-535 μ long (10)
- 9b. Antheridia 360 μ in diameter; oospore membrane grumous; oospores 540-560 μ long **5. N. praelonga**
- 10a. Oospores 275 μ long; branchlets 8 in a whorl; antheridia 245 μ in diameter **6. N. mexicana**
- 10b. Oospores 500-535 μ long; branchlets about 6 in a whorl; antheridia 285 μ in diameter **7. N. californica**
- 11a. Plants strict in habit, frequently lime-incrusted; oospores 260-300 μ long **8. N. Bastini**
- 11b. Plants not strict in habit, not lime-incrusted; oospores 375-600 μ long (12)
- 12a. Gametangia enveloped in mucus; striations of oospores very prominent and sharp-flanged **9. N. capillaris**
- 12b. Gametangia not enveloped in mucus; striations of oospores low and thick-flanged (13)
- 13a. Plants dioecious; dried specimens darkening to brown and becoming opaque; antheridia 650-775 μ in diameter **10. N. opaca**¹¹
- 13b. Plants monoecious; dried specimens generally pale and translucent; antheridia 500-675 μ in diameter **11. N. flexilis**
- 14a. Plants strict in habit, frequently lime-incrusted; oospore membrane reticulate; dioecious (8. *N. Bastini*)
- 14b. Plants not strict in habit, rarely lime-incrusted; monoecious or dioecious (15)

⁹ A 1-celled dactyl is interpreted in its strict sense. A terminal mucro is construed as a second cell, so that a dactyl with a mucro is considered a 2-celled dactyl. One with a crown of terminal mucros is considered a more-than-2-celled dactyl.

¹⁰ cf. also *N. clavata* — antheridia about 400 μ in diameter; dactyls 3 (—5), cells swollen.

¹¹ cf. also *N. occidentalis*.

- 15a. Plants 5–10 cm. high; dioecious; antheridia 600–800 μ in diameter; oospore membrane granular or roughened (17)¹²
- 15b. Plants 15–40 cm. high; monoecious; antheridia 200–650 μ in diameter; oospore membrane smooth to finely granular (16)
- 16a. Upper coronular cells of oogonia greatly elongated; oospore membrane perfectly smooth (3. *N. dilatata*)
- 16b. Upper coronular cells not elongated; oospore membrane varying ... (19)
- 17a. Oogonia isolated, 1 at a node; striations of oospores sharp and prominent, membrane roughened by scattered granules which are irregular in size **12. *N. Blankinshipii***
- 17b. Oogonia aggregated, 2–3 at a node; striations of oospores not sharp, membrane varying (18)
- 18a. Oospores 440 x 390–400 μ , membrane finely and evenly granular, striations of somewhat blunt ridges; antheridia 750 μ in diameter **13. *N. montana***
- 18b. Oospores 345–400 x 320–365 μ , membrane coarsely granular or roughened with elevations and depressions, striations not blunt; antheridia about 800 μ in diameter **14. *N. occidentalis***
- 19a. Fertile whorls contracted into heads or clumps (20)¹³
- 19b. Fertile whorls not contracted into heads, but becoming crowded above **15. *N. stellaris***¹³
- 20a. Heads loose, somewhat elongated; dactyls abbreviated and inflated centrally (21)
- 20b. Heads compact and rounded; dactyls not abbreviated or inflated centrally **16. *N. acuminata***
- 21a. Antheridia 650 μ in diameter; fertile whorls not enveloped in mucus ... **17. *N. missouriensis***
- 21b. Antheridia about 240 μ in diameter; fertile whorls enveloped in mucus (?) **18. *N. subspicata***
- 22a. Dactyls 1–2 celled, but the terminal cell not a mucro (1. *N. Macounii*)
- 22b. Dactyls (1—) 2 or more celled, terminal cell a mucro (23)
- 23a. Branchlets in each whorl consisting of two series, one set (accessory branchlets) shorter than the other **19. *N. hyalina***
- 23b. Branchlets in each whorl consisting of a single series of similar branchlets (24)
- 24a. Branchlets in a whorl heteromorphous, some divided and others undivided **20. *N. Leibergi***
- 24b. Branchlets in a whorl quite similar (25)
- 25a. Dactyls regularly 3 or more celled, not terminated by a 2–4 cuspidate crown (26)
- 25b. Dactyls 1–3 (–4) celled, or terminated by a 2–4 cuspidate crown (27)
- 26a. Sterile branchlets once divided, fertile branchlets 1–3 times divided **21. *N. capitellata***
- 26b. Sterile and fertile branchlets 3–4 times divided **22. *N. capillata***
- 27a. Sterile dactyls terminated by a 2–4 cuspidate crown (28)
- 27b. Sterile dactyls terminated by a 1-celled mucro (32)
- 28a. Fertile whorls forming compact heads or spikes (29)
- 28b. Fertile whorls not forming compact heads or spikes (31)

¹² Certain forms of *N. capillaris* with acuminate dactyls will key out at this dichotomy — plants 20–25 cm. high forming dense heads; antheridia about 600 μ in diameter; oospore striations 6, very sharp-flanged.

¹³ cf. also *N. clavata* — see footnote 10 for entry 8.

- 29a. Oospore membrane granular; antheridia about 520 μ in diameter; branchlets and axial nodes swollen **23. *N. annularis***
- 29b. Oospore membrane grumous or reticulate; antheridia 170–270 μ in diameter; nodes not particularly swollen (30)
- 30a. Heads terminal and axillary; oospore membrane grumous; antheridia about 170 μ in diameter **24. *N. Morongii***
- 30b. Heads strictly axillary; oospore membrane reticulate; antheridia 220–270 μ in diameter **25. *N. axillaris***
- 31a. Oogonia strictly solitary **26. *N. oligospira***
- 31b. Oogonia aggregated, 2 or more at a node **27. *N. microcarpa***
- 32a. Branchlets once divided (33)
- 32b. Branchlets (1—) 2 or more times divided (34)
- 33a. Fertile whorls forming compact heads (cf. entry 29)
- 33b. Fertile whorls not forming compact heads (34)
- 34a. Gametangia occurring at first branchlet nodes (36)
- 34b. Gametangia not occurring at first branchlet nodes (35)
- 35a. Branchlets exceeding the stem internodes in length **28. *N. transilis***
- 35b. Branchlets not exceeding stem internodes in length **29. *N. tenuissima***
- 36a. Dactyls strictly 2 celled (37)
- 36b. Dactyls indiscriminately 2–3 (or more) celled (39)
- 37a. Oospores 200–250 μ long, membrane strongly reticulate; gametangia not enveloped in mucus (cf. entry 29)
- 37b. Oospores 230–400 μ long (38)¹⁴
- 38a. Penultimate cells of dactyls tapering toward the base of the mucro, so that both cells are of nearly equal diameter at their conjunction (39)
- 38b. Penultimate cells not tapering, rounded at apex, several times broader than the base of the mucro at their conjunction **30. *N. mucronata***
- 39a. Plants minute, stems 130–250 μ in diameter (40)
- 39b. Plants larger, stems 300 or more μ in diameter (42)
- 40a. Branchlets 1–2 times divided; oospores 350 x 285 μ , mature membrane granular; antheridia 200 μ in diameter **31. *N. minuta***
- 40b. Branchlets 2–3 times divided; mature oospore membrane reticulate (41)
- 41a. Oospore striations prominent and flanged; antheridia 175–200 μ in diameter **32. *N. Nordstedtiana***
- 41b. Oospore striations faint, not flanged; antheridia 240–250 μ in diameter **33. *N. pygmaea***
- 42a. Fertile whorls contracted into pedunculate heads, enveloped in mucus; oospore membrane grumous, antheridia about 170 μ in diameter¹⁵ **34. *N. Asagrayana***
- 42b. Fertile whorls diffuse or in heads (heads not pedunculate), with or without mucus; oospore membrane not grumous; antheridia 240–400 μ in diameter (43)
- 43a. Oospore membrane reticulate (44)
- 43b. Oospore membrane not reticulate (45)
- 44a. Upper axial internodes 1–2 times the length of the branchlets; oogonia solitary (rarely geminate) (30. *N. mucronata*)
- 44b. Upper axial internodes $\frac{1}{2}$ –1 times the length of the branchlets; oogonia aggregated, 2–4 (— more) at a node (27. *N. microcarpa*)
- 45a. Dactyls 2–3, 2 (rarely 3) -celled; oospore 360 μ long; antheridia 240 μ in diameter; fertile whorls enveloped in mucus **35. *N. intermedia***

¹⁴ cf. also *N. oligospira*.¹⁵ cf. also *N. Morongii*.

45b. Dactyls 3-4, 2-3-celled; oospores 250-300 μ long; antheridia 300 μ in diameter; fertile whorls not enveloped in mucus 36, *N. gracilis*

1. *Nitella Macounii* Allen

Tolypella Macounii Allen, Bull. Torrey Bot. Club 14: 212 (descr.), pl. 72-73. 1887. — *ibid.*, 15: 11 (= *Nitella Macounii* Allen). 1888.

Nitella Macounii Allen, Bull. Torrey Bot. Club 15: 11 (descr.). 1888.

LITERATURE FOR NORTH AMERICA:

Tolypella Macounii: Allen (1887: 212). — *ibid.* (1888: 11) (= *N. Macounii* Allen).

Nitella Macounii: Allen (1887: 212). — Char. Amer. 1: 39, 43 (key). 1888. — Nordstedt, Lunds Univ. Årsskr. 25(4): 7. 1889. — Allen, Char. Amer. 2(1): 2 (key). 1892. — *ibid.*, 2(2): 9 (key), 14 (descr.), pl. 14. 1894.

Plant monoecious, 5-10 cm. high, densely tufted and much branched. **Sterile branchlets** about 8 in a whorl, heterophyllous in that a few are undivided, forming elongate 2-celled branchlets; some 2-3 times divided, terminating in about 4, 2-celled dactyls. **Dactyls of sterile branchlets** 2-celled, with abrupt point (not mucronate). **Fertile branchlets** once or twice divided, frequently terminating in 4 dactyls. **Dactyls of fertile branchlets** frequently 4, 2-celled (not mucronate), abruptly pointed. **Gametangia** occurring at ultimate branchlet furcation. **Oogonia** aggregated, 2-3 together. **Oospores** 210-215 μ long, 200-210 μ broad; **striations** of 7-8 ridges; **membrane** marked by short elevations at right angles from the ridges and irregularly distributed in the fossae. **Antheridia** terminal in ultimate branchlet furcations (further data not given).¹⁶

ILLUSTRATIONS: Allen (1887: pl. 72-73; 1894: pl. 14).

EXSICCATAE: None. Specimen: *J. Macoun* 8, July 6, 1883. Above the Fall, Canada Side, shore of the Niagara River, Canada (NY).

DISTRIBUTION FOR NORTH AMERICA: **Canada**: — shore of Niagara River, Allen (1887: 212; 1888: 11; 1894: 15) (TYPE LOCALITY); **United States** (?): — Lake St. Clair, Allen (1894: 15).

Allen first described this plant as a *Tolypella*, based on the specimen cited as "collected by Prof. John Macoun near Niagara Falls, and subsequently in Lake St. Clair." He later discovered the terminal position of the antheridia, and redescribed the plant as a *Nitella*.

2. *Nitella clavata* Kützting

Nitella clavata Kützting, Spec. Alg. p. 518. 1849. — Bertero ex Braun, Hooker's Journ. Bot. 1: 195. 1849. (nom. nud.).

Chara clavata Gay, Hist. Fis. y Pol. Chile 6: 551. 1854.

LITERATURE FOR NORTH AMERICA:

Nitella clavata: Braun, Abh. k. Akad. Wiss. Berlin (1882): 43. 1883. — Allen, Char. Amer. 1: 42 (fig. 46), 43 (key), 46. 1888. — Nordstedt, Lunds Univ. Årsskr. 25(4): 7. 1889. — Allen, Char. Amer. 2(1): 2 (key), 5. 1892. — *in* Williams, Bull. Torrey Bot. Club 19: 194. 1892. — Char. Amer. 2(2): 9 (key), 12, 13, pl. 12. 1894. — Bull. Torrey Bot. Club 23: 7. 1896. — Daily, Butler Univ. Bot. St. 6: 151. 1944.

¹⁶ Allen (1894: 14).

Nitella translucens: Halsted (pro parte, cf. *N. praelonga*), Proc. Boston Soc. Nat. Hist. 20: 175. 1879.¹⁷

Plant monoecious, very translucent, 40–50 cm. high. **Stem** stout, the branchlets nearly equal the stem internodes in diameter. **Branchlets** of two kinds in a whorl, an inner shorter whorl and an outer longer whorl bearing dactyls. **Sterile branchlets** 6–8 in a whorl, undivided. **Fertile branchlets** 3–6 (–8) in a whorl, once divided into 3 (rarely 5) dactyls. **Dactyls** 3 (rarely 5), short, swollen cells, terminating in an abrupt or acuminate point. **Gametangia** borne at the node of the fertile branchlets; not enveloped in mucus (?). **Oogonia** usually 3, lateral at the fertile branchlet nodes. **Oospores** 300–470 μ long, 300–420 μ wide; **striations** showing 6–7 prominent and sharp ridges; **membrane** minutely granular. **Antheridia** 300–400 μ in diameter.¹⁸

ILLUSTRATIONS: Allen (1894: pl. 12), Braun (1883: pl. 1, fig. 33, 34).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXVIII, 1381. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *M. A. Howe*, Oct. 1892. Lake Merced, San Francisco, Calif.; *H. N. Bolander*, Oct. 22, 1865. In water works, San Francisco, Calif.; *C. G. Pringle*, Oct. 5, 1838. Arroyo Ancho, Sierra Madre, Western Chihuahua, Mexico.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Orizaba, Braun (1883: 43), Nordstedt (1889: 7); — San Luis Potosi, Allen (1894: 13); **United States**: — California, Braun (1883: 43), Allen (1894: 13); — Missouri, Allen (1894: 13); — Montana, Allen in Williams (1892: 194), Allen (1894: 13); — Nebraska, Daily (1944: 151); — New Mexico, Allen (1894: 13), Braun (1883: 43); — North Carolina, Braun (1883: 53); — Oregon, Allen (1894: 13).

Allen (1894: 12) stated that this species was essentially a Pacific Coast species.

TYPE LOCALITY: Vittoria, Brazil.

The credit for this species is usually given to Bertero and Braun in the citation *N. clavata* (Bertero) Braun. This practice is apparently based upon the first mention in the literature, which was by Braun (1849: 195), in which Bertero's name appeared as the author, and meant to give credit to Bertero who collected the specimen (Coll. No. 167, as *Chara clavata* Bertero, ined.). However, as this was published without description, it must be considered a *nomen nudum* without valid status. The first published description was by Kützing (1849: 518) based on the specimen cited as "In Brasilia legit Sellow (v. in herb. Berolinensi)." Groves, H. and J. (1911: 33) are the only writers who have recognized Kützing as the author of this species.

***Nitella clavata* var. *inflata* Braun**

Nitella Pottsii Seemann, in litt. 1855.

¹⁷ Halsted lists the specimens — [*Bolander*], San Francisco water works; and *C. Wright* 1, from West Texas; both of which concur with those listed under *N. clavata* by Braun (1883: 43).

¹⁸ Allen (1894: 12).

Nitella clavata var. *Mülleri* Schaffner, in sced. 1856;¹⁹ Fl. Mex. Exsicc. (ined.), No. 314.

Nitella clavata var. *inflata* Braun, Abh. k. Akad. Wiss. Berlin (1882): 43. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella clavata var. *Mülleri*: Braun (1883: 43, 143).

Nitella clavata var. *inflata*: Allen, Char. Amer. 2(2): 12, 13. 1894.

This variety differs from the species by the enormously inflated branchlets, such that the fertile branchlets resemble small balls 5 mm. in diameter. Oogonia are often stipitate; and the oospores may have 8 angles.²⁰

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 34).

EXSICCATAE: None [?].

DISTRIBUTION FOR NORTH AMERICA: **Mexico**:—Tacubaya near Mexico City, and Chapultepec, Braun (1883: 43) (TYPE LOCALITIES); **United States**:—California, Allen (1894: 13) for the Santa Catalina Islands.

This variety was described by Braun (1883: 43) based on the specimen cited as "In einer einzigen Lagune bei Tacubaya in der Nähe der Stadt Mexico (gef. Aug. 1854 von Wilhelm Schaffner. Mexico, L. Hahn 1868). Sehr selten in Wassergräben zwischen den Lagunen bei Chapultepec, Mai 1854 (c. Potts)."

Apparently Allen's (1894: 12) verbatim repetition of Braun's words is the only further study which has appeared in the literature concerning this variety.

3. *Nitella dilitata* Allen

Nitella dilitata Allen, Char. Amer. 2(2): 13. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella dilitata: Allen, l.c., p. 9 (key), 13 (descr.), pl. 13.

Plant monoecious (?). **Branchlets** 6 in a whorl. **Sterile branchlets** simple or once divided. **Fertile branchlets** once divided, and contracted into dense heads. **Dactyls of fertile branchlets** (2-) 3 (-5), 1-celled, somewhat inflated below, tapering to an acute point. **Gametangia** occurring together at the division of the branchlets, mucus (?). **Oogonia** solitary or aggregated; **coronula** deciduous, the upper series of cells greatly elongated, much longer than the lower series. **Oospore** 440-480 μ long, 360-375 μ broad; **striations** of 6-7 not prominent ridges; **membrane** perfectly smooth. **Antheridia** 530-580 μ in diameter.²¹

ILLUSTRATIONS: Allen (1894: pl. 13).

EXSICCATAE: No duplicates have been issued. Original specimen (NY).

DISTRIBUTION FOR NORTH AMERICA: **Canada**:—New Brunswick, Allen (1894: 13) for Canaan Forks (TYPE LOCALITY).

The literature on this species seems to be limited to the original paper by Allen (1894), in which the species was described on the specimen cited as

¹⁹ Sced., cf. footnote to Species 34, *N. Asagrayana*.

²⁰ Allen (1894: 12).

²¹ Allen (1894: 13).

"Prof. Macoun, of Canada, collected by Mr. John Moser, at Canaan Forks, New Brunswick." Allen (1894: 14) states that this locality may be incorrect, possibly having been confused with a locality for *N. clavata*.²²

4. *Nitella obtusa* Allen

Nitella temiscouatae Allen, Bull. Torrey Bot. Club **19**: 230. 1892. (nom. nud.).

Nitella obtusa Allen, Char. Amer. **2**(1): 1 (footnote, key), 3 (descr.), pl. 2, 2a. 1892.

LITERATURE FOR NORTH AMERICA:

Nitella temiscouatae: Northrop and Northrop, Bull. Torrey Bot. Club **17**: 30. 1890. (sine nom.).²³

Nitella obtusa: Allen, Char. Amer. **2**(1): 1 (footnote, key), 3 (descr.), pl. 2, 2a. 1892.

Plant dioecious, 20–25 cm. high, densely tufted. **Sterile branchlets** (7–) 8, 3–5 cm. long, exceeding the axial internodes in length, once divided into 1–3 dactyls. **Fertile branchlets** 1–3, 1-celled, becoming progressively shortened upward forming a long terminal stem, once divided into 1–2 dactyls. **Dactyls of fertile branchlets** usually 2, 1-celled, one generally much reduced. **Gametangia** borne on separate plants. **Oogonia** solitary or aggregated, enveloping cells with blunt, usually inflated tips; **coronula** evanescent. **Oospores** about 460 μ long, 400 μ broad; **striations** of 7 thick and prominent ridges; **membrane** granular. **Antheridia** (no data given).²⁴

ILLUSTRATIONS: Allen (1892: pl. 2).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *T. Morong* 7, Aug. 25 & 27, 1891. Lake Temiscouata, Province of Quebec, Canada.

DISTRIBUTION FOR NORTH AMERICA: **Canada**: — Quebec, Lake Temiscouata (TYPE LOCALITY), Allen (1892: 3).

The literature is restricted to the works of the original author, the description being based on the specimen cited as "gathered by the late Dr. Northrup²⁵ and his wife in Lake Temiscouata, Canada."

5. *Nitella praelonga* Braun

Nitella flexilis subsp. *N. praelonga* Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 796. 1868. (nom. nud.).

Nitella praelonga Braun, Abh. k. Akad. Wiss. Berlin (1882): 40 (descr.). 1883.

LITERATURE FOR NORTH AMERICA:

Nitella praelonga: Ravenel, Bull. Torrey Bot. Club **6**: 82. 1876. (nom. nud.). — Allen, Char. Amer. **2**: 10. 1880. (nom. nud.). — Braun, Abh. k. Akad. Wiss. Berlin (1882): 40. 1883. — Allen, Char. Amer. **1**: 8, 43 (key). 1888. — *ibid.*,

²² The writer awaits any specimens or confirmed records of *N. clavata* for New Brunswick, which might substantiate Allen's conjecture.

²³ Reported collecting two Charas en route between Notre Dame du Lac and Mount Wissick, in a portion of Lake Temiscouata. One (?) of these is presumably the type specimen of *N. obtusa*.

²⁴ Allen (1892: 3).

²⁵ Misspelled for Northrop.

2(1): 2 (key). 1892.—ibid., 2(2): 11, 12, pl. 11. 1894.—Lillick, Papers Michigan Acad. 22 (1936): 149. 1937.

Nitella gelatinosa var. *gigantea*: Halsted, Proc. Boston Soc. Nat. Hist. 20: 174. 1879. (= *N. praelonga* Braun, according to Braun (1883: 40) and Allen (1894: 11)).

Nitella translucens: Halsted (pro parte, cf. *N. clavata*), l.c., p. 175.²⁶

Plant monoecious, robust. **Stem** up to 2.5–3 mm. in diameter, and 1.5–2 meters high. **Branchlets** 8 in a whorl. **Sterile branchlets** undivided, 1-celled, terminating in an abrupt point. **Fertile branchlets** once divided. **Dactyls of fertile branchlets** 2–3, 1-celled. **Gametangia** aggregate at the node of the fertile branchlets, enveloped in mucus. **Oogonia** 730–780 μ long by 600–650 μ wide. **Oospores** black, 540–560 μ long by 500–550 μ wide; **striations** of 6–7 sharp and prominent ridges; **membrane** grumous, having the appearance of matted felt. **Antheridia** about 360 μ in diameter, borne on elongated spikes.²⁷

ILLUSTRATIONS: Allen (1894: pl. 11), Lillick (1937: pl. 17, 18).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: C. Mohr, May 28, 1884. Mobile, Alabama (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Illinois, Braun (1883: 42); — South Carolina, Ravenel (1876: 82), Braun (1883: 40) for the Santee Canal (TYPE LOCALITY), Allen (1894: 11); — Texas, Braun (1883: 41) which reported the specimen in Lindheimer's Flora Texana Exsiccatae²⁸ No. 753, Lillick (1937).

The name *N. praelonga* first appeared in the literature in Braun's (1868: 796) "Die Characeen Afrika's" without a description. He later described the species in his "Fragmente einer Monographie der Characeen" (1883: 40) based on Ravenel's (1876: 82) specimen which Braun cited as "Nord-Amerika. In Carolina australi 'submersed in the Santee Canal' (C. Ravenel comm. Engelmann 1853 sub no. VII)."

Allen's description (1894: 11) was practically a verbatim translation of Braun's words with an error in the size of the oospore, which was translated as "500 to 560 microns" instead of the original "0,54–56 mm.," and the omission of the number of branchlets in a whorl which Braun gave as eight. Halsted's (1879: 174) description of his *N. gelatinosa* var. *gigantea* agreed rather closely with that of Braun's original for *N. praelonga*.

The species is generally conceded to be one of the largest Charophytes known, and is certainly the largest in the United States, generally reaching its maximum proportions in warm waters of the southern states.

²⁶ Halsted lists the specimen — *F. Lindheimer*, Aug. 1847, near Guadalupe, Flora Texana, No. 41. Braun determined this (No. 461[?]) as *N. praelonga*.

²⁷ Braun (1883: 40), supplemented from Allen (1894: 11).

²⁸ The reference to Lindheimer, Flora Texana Exsiccatae, appears in Braun's (1883: 41) works, but in correspondence with the University of Texas, the writer has been informed by Dr. B. C. Tharp of that institution that "So far as I know this was a purely herbarium duplicate issue." The specimens are now deposited in the Missouri Botanical Garden, St. Louis, Mo

6. *Nitella mexicana* Allen

Nitella mexicana Allen, Bull. Torrey Bot. Club **21**: 165 (descr.), pl. 186. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella mexicana: Allen, l.c. — *ibid.*, **23**: 533. 1896.

Plant monoecious. **Branchlets** 8 in a whorl, once divided. **Dactyls** 2–3, 1-celled, apiculate. **Gametangia** aggregated, not enveloped in mucus. **Oogonia** aggregated, 1–3 at a node. **Oospores** 275 μ long, 230 μ wide; **striations** of 5 prominent ridges; **membrane** very finely granular. **Antheridia** 245 μ in diameter.

ILLUSTRATIONS: Allen (1894: pl. 186).

EXSICCATAE: None issued. Specimen: *Brooks*, Oct. 4, 1890. San Luis Potosi, Canoas, Mexico (NY).

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — San Luis Potosi, Canoas, Allen (1894: 165) (TYPE LOCALITY).

Allen (1894: 165) originally described the species on the specimen cited as "collected by Mr. Pringle in slow-flowing streams in Mexico."

7. *Nitella californica* Allen

Nitella californica Allen, Bull. Torrey Bot. Club **21**: 166. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella californica: Allen, l.c. — *ibid.*, **23**: 533. 1896.

Plant monoecious, of medium size, similar to *N. flexilis*. **Fertile branchlets** once divided, about 6 in a whorl. **Fertile dactyls** 1-celled, abruptly pointed. **Sterile branchlets** 6 in a whorl, not or once divided. **Dactyls of sterile branchlets** elongated, often incurved. **Gametangia** aggregated, usually 2 oogonia and 1 antheridium at a node. **Oogonia** usually 2 at a node; **coronula** not persistent. **Oospores** 500–535 μ long, 450–530 μ wide; **striations** 6–7, prominent; **membrane** granular. **Antheridia** 285 μ in diameter.²⁹

ILLUSTRATIONS: Allen (1894: pl. 185).

EXSICCATAE: Allen, under the label title "Characeae Americanae Exsiccatae," but apparently issued posthumously by the New York Botanical Garden: *Blankinship*, 1894. Lake Co., Calif. (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — California, Allen (1894: 166) for Lake County (TYPE LOCALITY).

The literature for this species is limited to the original description and one additional note defining a forma *nidifica*. The species description by Allen (1894: 166) is based on the specimen cited as ". . . collected by Mr. J. W. Blankinship, in Lake County."

***Nitella californica* forma *nidifica* Allen**

Nitella californica forma *nidifica* Allen, Bull. Torrey Bot. Club **21**: 166. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella californica forma *nidifica*: Allen, l.c. — Char. Amer. Exsicc. 1893. (cf. under Exsiccatae).

²⁹ Allen (1894: 166).

This form differs from the species *N. californica* Allen in having the fertile whorls condensed into rather tight heads.³⁰

ILLUSTRATIONS: None.

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXIX, 1434; Allen, under the label title "Characeae Americanae Exsiccatae," but apparently issued posthumously by the New York Botanical Garden: *J. W. Blankinship*, June 12, 1893. Humboldt Co., Calif.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — California, Allen (1894: 166) for Humboldt County (TYPE LOCALITY).

The literature for this form is limited to the original description by Allen (1894: 166) based on the specimen cited as "... collected by the same gentleman [Mr. J. W. Blankinship] in Humboldt County, June 12, 1893."

8. *Nitella Bastini* Allen

Nitella Bastini Allen, Char. Amer. 2(2): 10. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella Bastini: Allen, l.c., p. 9.

Plant dioecious, 2–3 cm. high, quite rigid, occasionally incrusting with lime; two sexes somewhat different. **Branchlets** 8–12 in a whorl, once divided; in female plants, the primary rays 2675 μ long by 320 μ in diameter. **Dactyls** variously 1–3, unequal in length, all 1-celled, tapering to an abruptly acuminate point. **Gametangia** occurring on separate plants, enveloped in mucus; apparently sometimes stipitate. **Oogonia** aggregated, occurring at the base of the primary ray or at the branchlet node. **Oospore** 265–300 μ long, 235–250 μ wide; **striations** of 7–8 ridges; **membrane** irregularly but markedly reticulate. **Antheridia** 600–625 μ in diameter.³¹

ILLUSTRATIONS: Allen (1894: pl. 10).

EXSICCATAE: Allen, Char. Amer. Exsicc. 42; Phyc. Boreali-Amer., Fasc. XXIX, 1433; and also issued as unnumbered specimen under the title "Characeae Americanae Exsiccatae."

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Illinois, Allen (1894: 10) for site of the World's Fair, Chicago (TYPE LOCALITY, now destroyed).

The literature for this species is limited to the original description by Allen (1894: 10), based on the specimen cited as "Chicago, near that city, on the site of the World's Fair (the original locality is destroyed) [collected by Bastin]."

9. *Nitella capillaris* (Krock) Groves and Bullock-Webster

Chara capillaris Krock, Florae Silesiacae 3: 62. 1814.

Chara capitata Nees von Esenbeck, Denkschr. k. beierisch. bot. Gesell. 2: 80. 1818. — non Elliott (1824: 516) (= *N. capitellata* Braun).

Nitella capitata Agardh, Syst. Alg. p. 125. 1824.

Nitella capillaris Groves & Bullock-Webster, Brit. Char. 1: 96. 1920.

LITERATURE FOR NORTH AMERICA:

?*Chara capitata*: Riddell (ined.) — ?

³⁰ Allen (1894: 166).

³¹ Allen (1894: 10).

Nitella capitata: Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 788, 783. 1868. — Allen, Bull. Torrey Bot. Club 2(3): 9. 1871. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 32. 1883. — Allen, Char. Amer. 1: 41 (key). 1888. — Dame and Collins, Fl. of Middlesex Co., Mass. p. 151. 1888. — Allen, Char. Amer. 2(1): 2 (key). 1892. — *ibid.*, 2(2): 9 (key), 10 (descr.), pl. 9. 1894. — non Halsted (1879: 173) (= *N. acuminata* subsp. *glomerulifera* Braun).

Plant dioecious, slender, up to 20–25 cm. high. **Branchlets** 6–9 in a whorl, once divided, the primary rays nearly equal in length to the secondary. **Fertile branchlets** very short, condensed into dense heads. **Dactyls** usually 2–) 3 (–4), 1-celled; apical cell variable from blunt to sharp pointed. **Gametangia** borne on separate plants, enveloped in mucus. **Oogonia** solitary or 2–3 together at the division of the branchlet, 550–575 μ long by 425–450 μ wide; **coronula** 25–35 μ high, deciduous. **Oospore** 375–400 μ long, 325–375 μ wide, and 300 μ thick; chestnut-brown; **striations** of about 6 very prominent and sharp-flanged ridges; **membrane** with minute, non-contiguous, rounded tubercles. **Antheridia** about 600 μ in diameter.³²

ILLUSTRATIONS: Allen (1894: pl. 9), Groves & Bullock-Webster (1920: pl. 6).

EXSICCATAE: Issued as duplicates of the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *T. F. Allen*, 1870. Islip, Long Island, New York; *A. B. Langlois*, Louisiana.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Braun (1883: 32), Allen (1894: 10), Dame and Collins (1888: 151); — New York, Braun (1883: 32), Allen (1894: 10).

TYPE LOCALITY: Europe.

Throughout the majority of Characean literature, this plant has been designated as *Nitella capitata* (Nees von Esenbeck) Agardh, or some combination of the author citation. Groves and Bullock-Webster (1920: 97) showed the earlier described *Chara capillaris* Krockner (1814: 62) to be at least in part identical to that of Nees von Esenbeck; and, hence, published the new combination *N. capillaris* (Krockner) Groves and Bullock-Webster. If, as these writers contend, Krockner's plant is identical to that of Nees von Esenbeck, their move is justified. If, as contemporary opponents contend, Krockner's description was not based upon that portion of the several species (which Krockner labeled under this name) which is now recognized as *N. capitata*, then the generally accepted synonym must be re-established.

From the point of view of North American *Nitellas*, two works should be mentioned. The first is Elliott's (1824: 516) description of a *Chara capitata* Elliott, which subsequently was redescribed and has become established as *Nitella capitellata* Braun (cf. under that species). The second is Halsted's (1879: 173) report of *Nitella capitata* Ag. for Uxbridge, Mass. This plant was shown by Braun (1883: 39) to be *Nitella acuminata* subsp. *glomerulifera* Braun.

³² Groves & Bullock-Webster (1920: 97), supplemented from Migula (1897: 112).

10. *Nitella opaca* (Agardh ex Bruzelius) Agardh(Non) *Chara flexilis* Linn., Spec. Alg. p. 1157. 1753. (= *N. flexilis* (Linn.) Ag.).*Chara flexilis* Smith, Eng. Bot. pl. 1070. 1802.*Chara opaca* Agardh ex Bruzelius, Obs. in Gen. Char. p. 16. 1824.*Nitella opaca* (Agardh ex Bruzelius) Agardh, Syst. Alg. p. 124. 1824.

LITERATURE FOR NORTH AMERICA:

Nitella opaca: Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 875. 1868. — Halsted, Proc. Boston Soc. Nat. Hist. **20**: 173. 1879. — Robinson, Fl. Essex Co., Mass. p. 146. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 32. 1883. — Allen, Char. Amer. **1**: 7, 40 (fig. 42), 41 (key). 1888. — Bull. Torrey Bot. Club **19**: 194, 230. 1892. — Char. Amer. **2**(1): 2, 3, pl. 1, 1a. 1892. — Collins, Fl. Mt. Desert, Me. p. 277. 1894. — Woods, Fl. Nebraska p. 124, pl. 27. 1894. — Sawyer, M. S. Thesis (ined.) p. 18. 1926. — Prescott, Univ. Iowa Studies Nat. Sci. **13**: 140. 1931. — Daily, Butler Univ. Bot. St. **6**: 152, pl. 1-c. 1944. — *ibid.*, **7**: 126. 1945.

? *Nitella syncarpa*: Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. (cf. Allen (1892: 2; 1894: 10)).

Plant dioecious, moderately stout. Internodes usually 2-4 times the length of the branchlets. **Branchlets** 6-7 in a whorl. **Sterile branchlets** once divided, usually stout. **Dactyls of sterile branchlets** 2-3, 1-celled. **Fertile branchlets** usually shorter than sterile branchlets, forming more or less dense heads (sometimes lax), once divided. **Dactyls of fertile branchlets** 1-celled. **Gametangia** occurring together at the division of the branchlets, not enveloped in mucus. **Oogonia** solitary or geminate, about 650-700 μ long by 500-565 μ broad; **coronula** 25-40 μ high, deciduous. **Oospore** spheroidal, sometimes broader than long, about 375-425 μ long, 350-400 μ wide, and 250 μ thick, dark chestnut-brown to almost black; **striations** of 7 rather thick ridges, often broadening into flanges at apex; **membrane** red-brown or yellow-brown, smooth or scabrous with wart-like protuberances. **Antheridia** large, about 650-775 μ in diameter.³³

ILLUSTRATIONS: Allen (1892: pl. 1), Groves & Bullock-Webster (1920: pl. 7), Woods (1894: pl. 27).

EXSICCATAE: Char. Amer. Exsicc. 33; Phyc. Boreali-Amer., Fasc. XXIX, 1436. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *Faxon*, July 20, 1884. Ammonoosuc Lake, White Mountains, N. H.; *Faxon*, July 20, 1885 (*ibid.*); *Faxon*, Sept. 1, 1884 (*ibid.*); *Pringle*, Aug. 21, 1896, Tlalpam, Valley of Mexico; *E. Faxon*, June 20, 1885. Westmore, Vt.; *E. Faxon*, June 19, 1884, Saco Lake, Wt. Mt., N. H.; *Faxon*, June 19, July 20, 1884. Source of Saco River, White Mountains, N. H.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Tabasco, Braun (1883: 32), Allen (1892: 3); **United States**: — California, Allen (1892: 3); — Indiana, Daily (1945: 126); — Iowa, Sawyer (1926: 18), Prescott (1931: 140); — Louisiana, Braun (1883: 32), Allen (1892: 3); — Maine, Collins (1894: 227); — Massachusetts, Robinson (1880: 146), Allen (1892: 3); — Montana, Allen (1892: 194, 230); — Nebraska, Woods (1894: 124), Daily (1944: 152); — Nevada, Braun (1883: 32), Allen (1892: 3); — New Hampshire, Allen (1892: 3); — New York, Allen (1892: 3); — Oregon, Allen (1892: 3); — Pennsylvania, Allen (1892: 3); — Texas, Braun (1883: 32), Allen (1892: 3); — Utah, Braun (1883: 32); **Canada**: — Allen (1892: 3).

TYPE LOCALITY: Europe.

³³ Groves & Bullock-Webster (1920: 100).

This plant was apparently first validly described by Smith (1802, pl. 1070) as *Chara flexilis* Smith. This name, however, was preoccupied by *C. flexilis* Linn. (1753) (= *N. flexilis* (Linn.) Ag.). The next later description appeared in Bruzelius (1824: 16) under the name "*C. opaca* Ag." Agardh (1824: 124) in the same year, but apparently at a later date, transferred the plant to the genus *Nitella* as *N. opaca*. In the synonymy he listed "*C. opaca* Ag. Bruz." Agardh, therefore, must have suggested the new species to Bruzelius, who published the name (Agardh ex Bruzelius), and subsequently Agardh made the transfer. The writer has for these reasons cited the name as *N. opaca* (Ag. ex Bruz.) Ag.

11. *Nitella flexilis* (Linn. pro parte) Agardh

Chara flexilis Linnaeus, Spec. Plant. p. 1157. 1753.

Nitella flexilis (Linnaeus, pro parte) Agardh, Syst. Alg. p. 124. 1824.

LITERATURE FOR NORTH AMERICA:

Chara flexilis: Riddell, Syn. Fl. West. States p. 110. 1835. (= ? *N. flexilis* (Linn.) Ag.).

Nitella flexilis: Kützinger, Spec. Alg. p. 514. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 261. 1854. — Allen, Bull. Torrey Bot. Club 2(3): 9. 1871. — Halsted, Proc. Boston Soc. Nat. Hist. 20: 175. 1879. — Robinson, Fl. Essex Co., Mass. p. 146. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 34. 1883. — Allen, Char. Amer. 1: 6, 30 (fig. 39), 40 (fig. 43). 1888. — Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888. — Owen, Pl. Nantucket p. 74. 1888. — Allen in Britton, Final Rep. St. Geol. (N. Jersey) 2: 356. 1889. — Char. Amer. 2(2): 1 (key), 2, 6, pl. 6, 6a, 6b. 1892. — Webber, Trans. Acad. Sci. St. Louis 6: 20. 1892. — Collins in Rand and Redfield, Fl. Mt. Desert, Me. p. 227, 1894. — Woods, Fl. Nebraska p. 123, pl. 26. 1894. — Allen, Bull. Torrey Bot. Club 23: 533. 1896. — Bach, Mich. Acad. Sci., Ann. Rep. 9: 126. 1907. — Burnham & Latham, Torreyia 23: 4. 1923. — Grier, Amer. Midl. Nat. 9: 60. 1924-5. — Daily, Butler Univ. Bot. St. 7: 126. 1945.

Plant monoecious, moderately stout. Internodes usually $1\frac{1}{2}$ -2 times as long as the branchlets. **Branchlets** 6-8 in a whorl, straight or slightly incurved; once divided or sometimes with one simple node; primary rays usually about twice the length of the secondary ray. **Fertile branchlets** usually similar to sterile branchlets, sometimes shortened and forming heads. **Dactyls** 2-3 (or single), 1-celled, acute (rarely slightly apiculate). **Gametangia** occurring together at the branchlet node. **Oogonia** usually 2-3 together, varying much in size, 625-900 μ long by 550-750 μ broad; enveloping cells swelling considerably at the apex; **coronula** about 40 μ high, deciduous. **Oospores** 500-575 μ long, 425-500 μ broad, 375 μ thick, dark reddish-brown to black; **striations** of 5-7 stout, prominent ridges which broaden into flanges at the apex; **membrane** smooth or scabrous with wart-like protuberances. **Antheridia** about 500-625 μ in diameter.³⁴

ILLUSTRATIONS: Allen (1892: pl. 6, 6a, 6b), Groves & Bullock-Webster (1920: pl. 8), Woods (1894: pl. 26).

EXSICCATAE: Char. Amer. Exsicc. 28, 29, 30; Phyc. Boreali-Amer., Fasc. XXIX, 1435, Fasc. XXXIV, 1691. Issued as duplicates from the herbarium of T. F. Allen

³⁴ Groves & Bullock-Webster (1920: 103).

apparently posthumously by the New York Botanical Garden: *W. G. Farlow*, 1870. Near Botanical Garden, Cambridge, Mass.; *J. W. Blankinship*, Aug. 26, 1893. Poley's meadow, Canaan Forks, Queen County, New Brunswick, Canada; *W. G. Farlow*, May 12, 1882. Fresh Pond, Cambridge, Mass.; *Blankinship*, Aug. 6, 1892. Sequoia Canon, Marin Co., California.

DISTRIBUTION FOR NORTH AMERICA: **United States**:—Indiana, Daily (1945: 126);—Maine, Collins in Rand & Redfield (1894: 227);—Massachusetts, Halsted (1879: 175), Robinson (1880: 146), Braun (1883: 34), Dame and Collins (1888: 151), Owen (1888: 74);—Michigan, Bach (1907: 126);—Nebraska, Webber (1892: 20), Woods (1894: 124);—New Jersey, Braun (1883: 34), Allen in Britton (1889: 356);—New York, Braun (1883: 34), Burnham & Latham (1923: 4), Grier (1924-5: 60);—Ohio, Braun (1883: 34).

TYPE LOCALITY: Europe.

The name *flexilis* is considered to have been first validly published by Linnaeus (1753: 1157). *Chara flexilis* Linn. was transferred to the genus *Nitella* by Agardh (1824: 124). Agardh's statement "*Chara flexilis*, Linn. (*quoad partem*)" indicates that only a portion of the plants designated by Linnaeus as *C. flexilis* was to be included within his definition of *N. flexilis*. Thus, the name *Nitella flexilis* (Linn. pro parte) Agardh has been established in the literature.

***Nitella flexilis* var. *longifolia* Braun apud Migula**

Nitella flexilis var. *longifolia* Braun, Consp. Syst. Char. Europ. p. 2. 1867. (nom. nud.).—Braun apud Migula in Rabenhorst, Krypt.-Fl. Deutschl. ed. 2: 5: 138. 1897.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis forma *longifolia*, *elongata*: Allen, Char. Amer. 1: 7. 1888.

The variety is to be distinguished from the species in that the branchlets are $1\frac{1}{2}$ times as long as the internodes of the axis; the plant being larger, less fully branched, less heavily fertile; and the plant generally forming more numerous individual plants from the substratum so as to give a bushy appearance in the field.³⁵

ILLUSTRATIONS: Allen (1892: pl. 6, fig. 2).

EXSICCATAE: Char. Amer. Exsicc. 29.

DISTRIBUTION FOR NORTH AMERICA: **United States**:—New York, Allen (1880: 29, exsicc.).

TYPE LOCALITY: Europe.

The earliest reference to this name that has come to the attention of the author is Braun (1867: 2), but is without description. The first actual description which has been found is by Migula (1897: 138), with Braun cited as the author. Thus, unless some earlier description is found among Braun's works, the citation for this species must be changed to read *Nitella flexilis* var. *longifolia* Braun apud Migula.

The name *N. flexilis* forma *longifolia*, *elongata*, which is to be found in Allen's works (1888: 7; 1880: No. 29, exsicc.), so far as has been found

³⁵ Migula in Rabenhorst (1897: 138).

by the author, lacks description or earlier publication. As such, it is considered a *nomen nudum*. Further consideration of the necessity of this *elongata* must await monographic treatment. In any case, it appears that Allen was mistaken in designating *longifolia* as a form instead of a variety, under which it was originally and subsequently published.

Nitella flexilis var. **nidifica** (Hartman) Groves, H. & J.

Chara nidifica Hartman, Sk. Fl., ed. 5, 1846.

Nitella flexilis γ *nidifica* Wallman, K. Vets.-Akad. Handl. (1852): 262. 1854.

Nitella flexilis var. *nidifica* Groves, H. & J., Journ. Bot. 21; rep. p. 3. 1884.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis var. *nidifica*: Allen, Char. Amer. 2: 11, pl. V-a. 1880. — Robinson, Fl. Essex Co., Mass. p. 146. 1880.

Nitella flexilis var. *subcapitata* (Braun ex Rabenhorst) Crépin, Bull. Soc. Bot. Belg. 2: 129. 1863. (= *N. flexilis* var. *nidifica*, according to Groves (1883: rep. p. 3)). — Allen, Bull. Torrey Bot. Club 2(3): 9. 1871. — Char. Amer. 2: 11. 1880. — Char. Amer. 1: 7. 1888. — Owen, Pl. Nantucket, p. 74, 1888.

Fertile branchlets very short, forming compact heads. Sterile branchlets often simple.³⁶

ILLUSTRATIONS: Allen (1880: pl. V, fig. a).

EXSICCATAE: Char. Amer. Exsicc. 30, as *N. flexilis* var. *subcapitata*.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Connecticut, Allen (1871: 9; 1880: 11); — Massachusetts, Robinson (1880: 146), Owen (1888: 74). These record *N. flexilis* var. *subcapitata*.

TYPE LOCALITY: Europe.

The first description of this plant appears to have been published by Hartman (1846) as *C. nidifica*. Wallman (1854: 262) transferred this plant to the genus *Nitella*, at which time he also reduced it to the status of a form of *N. flexilis*.

Nitella flexilis forma **subnidifica** Allen (nom. dub.)

Nitella flexilis forma *subnidifica* Allen, Char. Amer. 2(1): 6, pl. 6, fig. 2. 1892.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis forma *subnidifica*: Allen, l.c.

This form is to be distinguished from the species in bearing abundant gametangia, and having oospores with smooth membrane and sharply flanged ridges.³⁷

ILLUSTRATIONS: None.

EXSICCATAE: Char. Amer. Exsicc. 41.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — California, Allen (1892: 6) (TYPE LOCALITY ?, San Francisco, cf. Char. Amer. Exsicc. 41).

It is decidedly questionable whether Allen (1892: 6) actually meant to establish this form as a taxonomic entity, in the light of his discussion which is contained in the footnote concerning the use of form names

³⁶ Groves, H. & J. (1883: rep. p. 3).

³⁷ Allen (1892: 6).

as a convenient manner in which to designate variations, on the first page of his article. It seems more likely that it was meant as a descriptive term. In any case, his description, accompanied by figures and exsiccatae material, might be considered to form a perfectly valid publication for the new name. Whether Allen considered this form a member of any particular variety is not made clear.

Nitella flexilis var. **crassa** Braun

Nitella flexilis var. *crassa* Braun in Braun, Rabenh. & Stiz., Die Char. Europ. (exsicc.), No. 101 (descr.?). 1857-78. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 35. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis var. *crassa*: Allen, Char. Amer. 2: 12, pl. V-5. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 35. 1883.

Plant up to 15 cm. high. Branchlets about half the length of the stem internodes; rays very stout, nearly equal to the stem in diameter; usually once divided though occasionally undivided; secondary rays about $\frac{1}{3}$ as long as the primary rays, and about $\frac{1}{2}$ as thick.³⁸

ILLUSTRATIONS: None.

EXSICCATAE: None [?].

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Iowa, Allen (1880: 12); — Vermont, Allen (1880: 12); **Canada**: — Allen (1880: 12).

For North America, Braun (1883: 35).

TYPE LOCALITY: Europe.

The original variety description apparently appeared on the label on Braun, Rabenhorst, and Stizenberger's exsiccata specimen, No. 101.

12. Nitella Blankinshipii Allen

Nitella Blankinshipii Allen, Char. Amer. 2(1): 5. 1892.

LITERATURE FOR NORTH AMERICA:

Nitella Blankinshipii: Allen, l.c., p. 1. — Bull. Torrey Bot. Club 23: 7. 1896.

Plant dioecious, delicate, not over 5-10 cm. high. **Branchlets** 8 in a whorl, once divided, all similar except in rare instances of unequal size (heterophyllous); cells with very thin walls, tending to become dilated; primary ray 300 μ in diameter. **Dactyls** variously 2-4, 1-celled (?). **Gametangia** borne on separate plants. **Oogonia** usually solitary; **coronula** persistent. **Oospores** 450 μ long by 400 μ wide; **striations** of 6-7 sharp, prominent ridges; **membrane** roughened by scattered granules of irregular size. **Antheridia** 600 μ in diameter.³⁹

ILLUSTRATIONS: Allen (1892: pl. 4).

EXSICCATAE: Char. Amer. Exsicc. 43.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Allen (1892: 5; 1896: 7) (TYPE LOCALITY).

³⁸ Migula (1897: 139).

³⁹ Allen (1892: 5).

The description by Allen (1892: 5) is based on the specimen cited as ". . . gathered in Missouri by Mr. Blankinship."

Groves, H. and J. (1911: 31, footnote) suggested the advisability of uniting this species with *N. montana* Allen, *N. missouriensis* Allen, and *N. subglomerata* Braun into a single species under *N. acuminata* Braun.

13. *Nitella montana* Allen

Nitella montana Allen, Char. Amer. 2(1): 4. 1892.

Nitella montanae Allen, Bull. Torrey Bot. Club 19: 230. 1892. (nom. nud.).

LITERATURE FOR NORTH AMERICA:

Nitella montana: Allen, Char. Amer. 2(1): 1 (key), 4 (descr.), pl. 3. 1892.

Nitella montanae: Allen, l.c.

Plant dioecious, delicate and branched, 3–7 cm. high. **Branchlets** 8 in a whorl, once divided. Occasional additional short shoots may be present in whorl. **Dactyls** 1–3, 1-celled, gradually tapering to elongated point. **Gametangia**, sexes occurring on different plans, not enveloped in mucus. **Oogonia** numerous, 1–3 together at a division of the branchlets; **coronula** persistent. **Oospores** 440 μ long by 390–400 μ broad; **striations** of 7–8 somewhat blunt ridges; **membrane** finely and evenly granular. **Antheridia** 750 μ in diameter.⁴⁰

ILLUSTRATIONS: Allen (1892: pl. 3).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: Williams, Aug. 25, 1891. Great Falls, Montana (Sand Coulee Lake).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Montana, Allen (1892: 5) for Crater Lake, Mt. Agassiz (TYPE LOCALITY) and Great Falls, Sand Coulee.

Allen's first note on this species (1892: 230) cited his intention to describe, along with other new species, a "*Nitella montanae*." In the actual description, however, he changed the ending to "*Nitella Montana*," based on the specimen cited as ". . . from Crater Lake, Mt. Agassiz, gathered by U. S. Geol. Survey. Later by Mr. Williams from Sand Coulee, Montana."

Groves (1911: 31, footnote) suggested the advisability of uniting this species with *N. Blankinshipii* Allen, *N. missouriensis* Allen, and *N. subglomerata* Braun into a single species under *N. acuminata* Braun.

14. *Nitella occidentalis* Allen

Nitella occidentalis Allen, Bull. Torrey Bot. Club 21: 166. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella occidentalis: Allen, l.c., pl. 187. 1894.

Plant dioecious, 8–10 cm. high. **Branchlets** 6 in a whorl, once furcate. **Dactyls** (number not given), 1-celled, acuminate. **Gametangia** 2–3 together at the branchlet nodes, not enveloped in mucus. **Oogonia** (data not given). **Oospore** 345–390 μ long, 320–365 μ broad; **striations** of

⁴⁰ Allen (1892: 4).

6 not prominent ridges; **membrane** roughened with elevations, ridges, and depressions. **Antheridia** about 800 μ in diameter.⁴¹

ILLUSTRATIONS: Allen (1894: pl. 187).

EXSICCATAE: Issued as an unnumbered specimen under the herbarium label title "Characeae Americanae Exsiccatae," presumably posthumously by the New York Botanical Garden: *J. W. Blankinship*, June 1, 1893. Lake County, Calif. Other specimens, apparently from the same collection, were issued as duplicates from the herbarium of T. F. Allen by the same institution.

DISTRIBUTION FOR NORTH AMERICA: **United States**:—California, Allen (1894: 166) for Lake County (TYPE LOCALITY).

This species was described by Allen (1894: 166) based on the specimen cited as "Collected by Mr. Blankinship, in California, Lake County, June 1893." The only further reference to this species that the writer could find in the literature is the work of Groves, H. and J. (1911: 31), who did not alter the original status of the species.

15. *Nitella stellaris* Allen

Nitella stellaris Allen, Bull. Torrey Bot. Club 23: 534. 1896.

LITERATURE FOR NORTH AMERICA:

Nitella stellaris: Allen, l.c., p. 534, 536, pl. 285.

Plant monoecious, about 25 cm. high. **Branchlets** 8 in a whorl, once divided. **Dactyls of sterile branchlets** 2–4, short, 1-celled, gradually acuminate. **Dactyls of fertile branchlets** 2 (rarely 3), short, 1-celled, gradually acuminate. **Gametangia** aggregated on the branchlet node; mucus (?) (data not given). **Oogonia** aggregated at branchlet nodes (dimensions not given). **Oospores** 230–240 μ long, 225 μ broad; **striations** of 5–6 sharp ridges; **membrane** quite smooth. **Antheridia** about 215 μ in diameter.⁴²

ILLUSTRATIONS: Allen (1896: pl. 285).

EXSICCATAE: None issued. Specimen: *J. W. Blankinship*, 3, Aug. 21, 1895. In pond near Verdigris River, Creek Nation, Indian Territory (NY). (co-type ?).⁴³

DISTRIBUTION FOR NORTH AMERICA: **United States**:—Oklahoma, Allen (1896: 534) for a pond near Verdigris River, Creek Nation, Indian Territory (TYPE LOCALITY).

This new species was described by Allen (1896: 534) based on the specimen cited as ". . . collected by Mr. J. W. Blankinship, in a pond near Verdigris river, Creek Nation, Indian Territory, August 21, 1895." The significance of this species has been questioned by Zaneveld (1940: 57), who suggests that it be lumped along with *N. capitulifera* Allen and *N. subspicata* Allen into *N. acuminata* var. *subglomerata* Braun.

⁴¹ Allen (1894: 166).

⁴² Allen (1896: 534).

⁴³ At the time of the writer's inspection of the material in this herbarium, the types were apparently in the hands of G. O. Allen of England. As this specimen was not marked "type," it is assumed that the type was absent, and thus this duplicate material may be a co-type.

16. *Nitella acuminata* Braun ex Wallman*Nitella acuminata* var. *Bélangeri*⁴¹ Braun, Hooker's Journ. Bot. 1: 292. 1849.*Nitella acuminata* Wallman, K. Vets.-Akad. Handl. (1852): 263. 1854.

LITERATURE FOR NORTH AMERICA:

Nitella acuminata: Allen, Bull. Torrey Bot. Club 2(3): 9. 1871.—Char. Amer. 2: 10. 1880.—Char. Amer. 1: 41 (key). 1888.—in Mohr, Contrib. U. S.

Nat. Herb. 6: 147. 1901.—(cf. also under subspecies and varieties).

Division *Acuminatae*: Allen, Char. Amer. 2(1): 7. 1892.

Plant monoecious, bright to brownish green, up to 25 cm. high. Stem moderately stout, 700–1500 μ in diameter. Internodes as long as up to $1\frac{1}{2}$ times the length of the branchlets. **Sterile branchlets** 6–8 in a whorl, up to 4 cm. long, well developed; in adult specimens curving outward, once furcate; primary rays $\frac{2}{3}$ – $\frac{3}{4}$ the length of the entire branchlet; secondary rays 2–3, seldom 4, much shorter than the primary rays, extremely variable in length. **Fertile branchlets** commonly forming dense heads, 2–3 such heads arising within a whorl; these branchlets sometimes bear not only compact heads but also a whorl of 6–8 longer fertile branchlets, about 1 cm. long, whereas the heads are about 0.2 cm. in diameter; both kinds of fertile branchlets are once furcate into 2 (–3) short, ultimate rays, not enveloped in mucus. **Dactyls of sterile branchlets** (2–) 3, up to 1 cm., unequal or equal in length, 1-celled, gradually tapering to an acuminate point. **Dactyls of fertile branchlets** 2–3, 1-celled, much shorter than those of sterile branchlets, up to 0.2 cm. long, and more or less conical. **Dactyls of fertile heads** 2–4, 1-celled, up to 790 μ long and 125 μ wide at the base. **Gametangia** occur together at the branchlet nodes, not enveloped in mucus. **Oogonia** 1–2 together, sessile, 280–510 μ long (including coronula), 240–400 μ wide; spiral cells showing 8–9 convolutions; **coronula** persistent, 33–85 μ high, 45–130 μ wide at the base, individual cells strongly converging. **Oospores** dark chestnut-brown, subdiaphanous (in dried specimens nearly black), 275–340 μ long, 225–300 μ wide; **striations** of (6–) 7 (–8) ridges; **membrane** minutely granular, diaphanous. **Antheridia** 230–310 μ in diameter.⁴⁵

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 22–26, pl. 4, fig. 88), Allen (1892: pl. 7).

EXSICCATAE: cf. under subspecies and varieties.

DISTRIBUTION FOR NORTH AMERICA: **United States**:—Alabama, Allen in Mohr (1901: 147).⁴⁶ (Cf. under subspecies and varieties).TYPE LOCALITY: Africa, Reunion (Île de la Réunion—formerly Île Bourbon), Wallman (1854: 263).⁴⁷

⁴¹ Zaneveld (1940: 60) has listed sufficient evidence to show that Braun's (1849: 292) original spelling of *Bellangeri* was an orthographic error, as the collector's name was Bélanger. Braun (1859: 355; 1868: 877) rectified this spelling in certain of his later works.

⁴⁵ Zaneveld (1940: 54).⁴⁶ This record is foreign to Allen's general policy of determining members of his *Acuminatae* to groupings with much finer distinctions. A study of the specimen will doubtlessly show the plant to fall into one of the subspecific forms.⁴⁷ The type locality of Braun's (1849: 293) specimen upon which he described *N. acuminata* var. "*Bélangeri*" is cited as "In pools near Gengu on the coast of Coromandel, . . . [India]."

Braun (1849: 292) is usually cited as the original author of this species. Actually, Braun did not describe the species until 1868, in his "Die Characeen Afrika's" (1868: 876), and in this work he cited the name in the description as a subspecies of *N. flexilis*. Braun (1883: 35) returned to his original usage of the distinct species in his "Fragmente einer Monographie der Characeen." The first valid publication of the species was by Wallman (1854: 263), in which he cited the earlier work of Braun accurately as "*Nitella acuminata* (Braun, id.) [= ined. ?]." Wallman based his description on the specimen cited as "Afrika, Isle Bourbon! Commerson." In accordance with Arts. 41 and 44 of the "International Rules of Botanical Nomenclature" (1935: 11, 12) which specify that "A group is not characterized, and the publication of its name is not validated, merely by mention of the subordinate groups included in it," Braun's (1849: 292) name cannot be considered validly published on the basis of his *N. acuminata* var. *Bélangeri* alone. For this reason, Wallman's description is the first validly published work.

Allen (1892: 7) proposed that, as the species *N. acuminata* encompassed so many distinct homogeneous groups, it should be raised to a division *Acuminatae*. As a result of his decision, he proceeded to raise the earlier subspecific entities to full species rank. Among those elevated on this basis are *N. glomerulifera*, *N. subglomerata*, and *N. Lindheimeri*. Among new species which he described within this group are apparently *N. stellaris*, *N. subspicata*, and *N. missouriensis*. As far as is known to the writer, no other monographer has seen fit to follow Allen's proposal, and Zaneveld (1940: 57) has outlined a much more conservative treatment (cf. under these species, subspecies, and varieties).

KEY TO THE SUBSPECIFIC FORMS OF *NITELLA ACUMINATA*

- 1a. Sterile branchlets not much longer than the fertile whorls; fertile whorls forming rather loose heads (2)
- 1b. Sterile branchlets much longer than the fertile whorls; fertile whorls forming dense heads subspecies *glomerulifera*
 - 2a. Branchlets 5-6 in a whorl; fertile branchlets 2-3 mm. long, 330-500 μ in diameter variety *Lindheimeri*
 - 2b. Branchlets 6-8 in a whorl; fertile branchlets exceeding limits for preceding variety variety *subglomerata* (3)
- 3a. Dactyls $\frac{1}{2}$ to $\frac{3}{4}$ as long as the primary rays variety *subglomerata* (typical form)
- 3b. Dactyls up to $\frac{1}{3}$ as long as primary ray variety *subglomerata* forma *brachytelea*

Nitella acuminata var. *Lindheimeri* Braun

Nitella acuminata var. *Lindheimeri* Braun, Hooker's Journ. Bot. 1: 293. 1849. (nom. nud.).—Abh. k. Akad. Wiss. Berlin (1882): 38. 1883.

Nitella Lindheimeri Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 355. 1859. (brief text descr.).

LITERATURE FOR NORTH AMERICA:

Nitella acuminata var. *Lindheimeri*: Braun, Hooker's Journ. Bot. 1: 293. 1849.
— Abh. k. Akad. Wiss. Berlin (1882): 38. 1883. — Allen, Char. Amer. 1: 43 (key). 1888.

Nitella Lindheimeri: Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 355. 1859. — Allen, Char. Amer. 2(1): 7. 1892. (as a spec. dub.).

Branchlets 5–6 in a whorl. Fertile branchlets 2.5–3 mm. long. 330–500 μ in diameter. Oogonia aggregate, at least 2 together.⁴⁸

ILLUSTRATIONS: None.

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Braun (1849: 293); — Texas, Braun (1849: 293; 1859: 355; 1883: 38), Allen (1892: 7). Braun (1883: 38) cites Lindheimer's specimen for Friedrichsburg (TYPE LOCALITY ?).

This plant was first described by Braun (1859: 355) in a brief statement based on the specimen cited as "*N. Lindheimeri* aus Texas." The first complete treatment for this species in the literature appears to have been made in his "Fragmente einer Monographie der Characeen" (1883: 38) for the specimen (apparently identical to the above) cited as "Friedrichsburg in Texas (*Lindheimer*)."

Zaneveld (1940: 59) included this entity within the limits of *N. acuminata* var. *Bélangeri* Braun. He delimited this variety based on Braun's original type⁴⁹ as follows:

Plants with very short dactyls, in the type specimen hardly visible with the naked eye, in other specimens up to as long as the diameter of the stem.

Allen followed Braun's (1883: 38) designation of this plant as a variety in his early papers; but he (1892: 7) not only returned to Braun's original usage as a full species, but stated that from the specimens he had seen it was apparently identical to *N. subglomerata* (= *N. acuminata* var. *subglomerata*). He, in essence, left it as a doubtful species.

***Nitella acuminata* var. *subglomerata* Braun**

Nitella subglomerata Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 356. 1859.

Nitella acuminata β *subglomerata* Braun, Abh. k. Akad. Wiss. Berlin (1882): 36. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella acuminata var. *glomerata*: Webber, Trans. Acad. Sci. St. Louis 6: 20. 1892. (= *subglomerata*, fide Daily (1944: 152)).

Nitella acuminata var. *subglomerata*: Allen, Bull. Torrey Bot. Club 2(3): 9. 1871. — Char. Amer. 2: 10. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 36. 1883. — Allen, Char. Amer. 1: 40 (fig. 44), 41 (key). 1888. — Nordstedt, Lunds Univ. Årsskr. 25(4): 7. 1889.

Nitella subglomerata: Allen, Char. Amer. 2(1): 2 (key), 7, pl. 7, 7a. 1892. — Woods, Fl. Nebraska, p. 123. 1894. — Daily, Butler Univ. Bot. St. 6: 151. 1944.

⁴⁸ Braun (1883: 38).

⁴⁹ Bélangier. 1826–'28. In pools near Gengu, Coromandel, India. (B).

Dactyls of sterile branchlets macroscopically visible, longer than $650\ \mu$. Primary rays up to $\frac{3}{4}$ as long as the secondary ray. Dactyls of the fertile branchlets very short.⁵⁰

ILLUSTRATIONS: Allen (1892: pl. 7, 7a), Braun (1883: pl. 1, fig. 22–26), Woods (1894: pl. 25).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen posthumously by the New York Botanical Garden: *J. W. Blankinship*, 1893. Missouri. Certain specimens were also issued with a label "Characeae Americanae Exsiccatae," but without numbers.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**:—near Mexico City, Braun (1883: 36), Allen (1892: 7); **United States**:—Illinois, Nordstedt (1889: 7), Braun (1883: 36), Allen (1892: 7);—Missouri, Allen (1892: 7);—Nebraska, Webber (1892: 20), Woods (1894: 123), Daily (1944: 151);—New Jersey, Allen (1892: 7);—New York, Allen (1892: 7);—Ohio, Braun (1883: 36);—Oregon, Allen (1892: 7);—Pennsylvania, Braun (1883: 36), Allen (1892: 7);—Texas, Braun (1883: 36), Allen (1892: 7).

TYPE LOCALITY: Panama (K).⁵¹

The first published description of this plant was by Braun (1859: 356) based on the specimen cited as "Prope Panama in consortio *Nit. microcarpae* 1846 legit Duchassaing (Herb. Hook.)." In his "Fragmente einer Monographie der Characeen" (1883: 36) he reduced it to a subspecific status, but did not indicate whether he proposed a rank of variety, subspecies, or form. Allen (1871: 9) followed Braun's later treatment by considering the plant a variety, but changed his mind (1892: 7) and returned to Braun's original concept of considering it a full species. Zaneveld (1940: 61), in monographing the Malaysian Charophyta, retained the variety status.

***Nitella acuminata* var. *subglomerata* forma *brachyteleles* Braun**

Nitella acuminata β *subglomerata* forma *brachyteleles* Braun, Abh. k. Akad. Wiss. Berlin (1882): 37. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella subglomerata var. *brachyteleles*: Allen, Char. Amer. 2: 10. 1880. (nom. nud.).—Braun, l.c. (descr.).—Allen, Char. Amer. 2(1): 7. 1892.

Nitella acuminata brachyteleles: Allen in Mohr, Contrib. U. S. Nat. Herb. 6: 147. 1901.

This form is characterized by the greatly abbreviated terminal segments of the branchlets.⁵²

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 25).

EXSICCATAE: None issued. Specimen: *Mohr*. Sept. 1881. Gently flowing deep or shallow water. Delta, Mobile River (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States**:—Alabama, Allen (1892: 7), Allen in Mohr (1901: 147);—Missouri, Braun (1883: 37) for pond on the hills N. West of St. Louis (TYPE LOCALITY), Allen (1892: 7) for the same specimen.

⁵⁰ Zaneveld (1940: 61).

⁵¹ (K), "Herb. Hook[er]," fide Braun (1859: 356).

⁵² Allen (1892: 7).

This form was described by Braun (1883: 37) as *N. acuminata* β *subglomerata* forma *brachyteles* based on the specimen cited as "Pond on the hills N. West of St. Louis (Aug. 1846 A. Fendler; Sept. 1848, Engelmann.)." Allen reported this form both as a variety of *N. subglomerata* and *N. acuminata*; but, as there seems to be no stated logic for these moves, the writer has retained the original form of the name. Zaneveld (1940: 59) included this form under *N. acuminata* var. *Bélangeri* Braun (cf. var. *Lindheimeri*).

***Nitella acuminata* subsp. *glomerulifera* Braun**

Chara flexilis subsp. *glomerulifera* Braun, Amer. Journ. Sci. & Arts 46: 92. 1844. (nom. nud.), as = ? *N. flexilis* f. (?).

(Non) *Chara glomerulifera* Ruprecht, Beiträge Pfl. russ. Reiches 3: 7. 1845. (= *Tolypella glomerata* (Desv.) Leonhardi (fide Braun (1868: 877) and Groves, H. & J. (1880: 162)).

(Non) *Nitella flexilis* δ *glomerulifera* Kützing, Spec. Alg., p. 514. 1849. (= *T. glomerata*).

(Non) *Nitella glomerulifera* Kützing, Tab. Phyc. 7: 32, pl. 81. 1857. (= *T. glomerata* (Desv.) Leonh., fide Groves (1880: 162)).

Nitella acuminata subsp. *glomerulifera* Braun, Abh. k. Akad. Wiss. Berlin (1882): 39. 1883.

LITERATURE FOR NORTH AMERICA:

Chara flexilis subsp. *glomerulifera*: Braun, l.c.

Nitella acuminata subsp. *glomerulifera*: Braun, l.c. — Allen, Char. Amer. 1: 40 (fig. 45), 43 (key). 1888. — Nordstedt, Lunds Univ. Årsskr. 25(6): 23. 1889.

Nitella capitata: Halsted, Proc. Boston Soc. Nat. Hist. 20: 173. 1879. (fide Braun (1883: 39)).

Nitella flexilis δ *glomerulifera*: Kützing, Spec. Alg. p. 514. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 262. 1854. (= *T. glomerata*).

Nitella flexilis var. *nidifica*: Robinson, Fl. Essex Co., Mass. p. 146. 1880. (Syn.: *C. glomerulifolia* A. Br. [misspelled for *C. glomerulifera* Braun]).

Nitella glomerulifera: Allen in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889. — Allen, Char. Amer. 2(1): 8 (descr.), pl. 8. 1892. — Bull. Torrey Bot. Club 23: 534. 1896.

This subspecies is readily distinguished from the species and other subspecific forms of *N. acuminata* by the dense masses of fruiting whorls which are collected into heads attaining a diameter of 8–10 mm., and are subtended by simple or once-divided sterile branchlets which long overtop the heads. Sterile branchlets often 40 mm. long. Oospore membrane thickly studded with roundish elevations or granules, averaging 1.5 μ in diameter. These markings are diagnostic in themselves.⁵³

ILLUSTRATIONS: Allen (1892: pl. 8), Nordstedt (1889: pl. 1, fig. 14, 15, for membrane).

EXSICCATAE: Char. Amer. Exsicc. 32. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: T. F. Allen, 1882. Sodus Bay, Lake Ontario.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Allen (1892: 8); — Massachusetts, Braun (1883: 39), Nordstedt (1889: 23), Allen (1892: 8); — New

⁵³ Allen (1892: 8).

Hampshire, Braun (1883: 39); — New Jersey, Allen (1892: 8); — New York, Allen (1892: 8); — Ohio, Allen (1892: 8).

TYPE LOCALITY: Merrimac River, Massachusetts (or New Hampshire ?).

The name *Chara glomerulifera* [A. Br., ined.] was first employed by Braun (1844: 92) but without description (*nomen nudum*). Ruprecht (1845: 7) described a different plant under this name, *C. glomerulifera* (= *Tolypella glomerata* (Desv.) Leonhardi). Kützing (1849: 514) transferred Ruprecht's plant to the genus *Nitella*, as *N. flexilis* ♂ *glomerulifera* (= *T. glomerata*). The first description of Braun's original plant appeared in Braun's "Fragmente einer Monographie der Characeen" (1883: 39) as *Nitella acuminata* subsp. *glomerulifera* based on the specimen cited as "'Amer. Sept. Green.' Herb. Decaisne. 'In the Merrimackriver' also in New-Hampshire oder Massachussets, wahrscheinlich aus Massachussets, wo der Merrimackfluss Boston am nächsten ist, indem Green bei Boston gesammelt hat."

Allen followed Braun in the use of the subspecific designation in his early works, but in his "Characeae of America" (1892: 8) raised it to the species *N. glomerulifera* (Braun) Allen.

17. *Nitella missouriensis* Allen (spec. dub.)

Nitella missouriensis Allen, Char. Amer. 2(1): 5. 1892.

LITERATURE FOR NORTH AMERICA:

Nitella missouriensis: Allen, l.c.

Plant (apparently) monoecious, diffusely branched, 15–20 cm. high. **Branchlets** (data not given in description, but plate shows 6–8). **Dactyls** 1-celled. **Gametangia** (data not given) without mucus. **Oogonia** (data not given). **Oospores** (data not given). **Antheridia** 650 μ in diameter.⁵⁴

ILLUSTRATIONS: Allen (1892: pl. 5).

EXSICCATAE: Specimens have been issued which bear the label title "Characeae Japonicae Exsiccatae"⁵⁵ without number: J. H. Kimmons, June 1895. Springfield, Missouri.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Allen (1892: 5) for Springfield (TYPE LOCALITY).

As indicated by Allen's (1892: 5) description, this was considered a doubtful species. Groves, H. and J. (1911: 31, footnote) suggested the advisability of uniting this species with *N. Blankinshipii* Allen, *N. montana* Allen, and *N. subglomerata* Braun into a single species under *N. acuminata* Braun. Allen, on the other hand, states that it would be unhesitatingly referred to *N. subcapitata* (= *N. flexilis* var. *nidifica*) except that in *N. missouriensis* the fruits are entirely devoid of mucus.

⁵⁴ Allen (1892: 5).

⁵⁵ Wood, Farlowia 3: 328. 1948, omits this specimen from Allen's "Char. Jap. Exsicc." on the grounds that it is an American collection and probably was intended to bear the label title "Char. Amer. Exsicc."

18. *Nitella subspicata* Allen

Nitella subspicata Allen, Bull. Torrey Bot. Club **23**: 6, pl. 253. 1896

LITERATURE FOR NORTH AMERICA:

Nitella subspicata: Allen, l.c.

Plant monoecious, 15–20 cm. high, diffusely branched. **Branchlets** once divided. **Sterile branchlets** widely spreading and diffuse. **Fertile branchlets** contracted into remotely spike-like heads arising within the whorls of sterile branchlets. **Dactyls** 3–4, 1-celled, long acuminate, somewhat inflated at the middle. **Gametangia** aggregated at the fertile branchlet node; mucus (?) (data not given). **Oogonia** 1–3 (generally 2) at a node; about 306 μ long. **Oospore** nearly black, 225 μ long, 200 μ broad; **striations** of 6 prominent ridges; **membrane** quite smooth. **Antheridia** about 240 μ in diameter.⁵⁶

ILLUSTRATIONS: Allen (1896: pl. 253).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: J. W. Blankinship, 1893. Springfield, Missouri. This specimen occasionally is accompanied by the label "Characeae Americanae Exsiccatae."

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Allen (1896: 6) for Springfield (TYPE LOCALITY).

This species was described by Allen (1896: 6), based on a specimen cited as "Collected in Missouri by J. W. Blankinship."

The significance of this species has been questioned, and Zaneveld (1940: 57) suggests lumping it along with *N. stellaris* Allen and *N. capitulifera* Allen under *N. acuminata* var. *subglomerata* Braun.

19. *Nitella hyalina* (DeCandolle) Agardh, pro parte

Chara hyalina DeCandolle in Lamark, Fl. Franc. **6**: 247. 1805.⁵⁷

Nitella hyalina (DC.) Agardh, Syst. Alg. p. 126. 1824.

LITERATURE FOR NORTH AMERICA:

Nitella hyalina: (cf. var. *Engelmanni*)

Plant monoecious, medium-sized, up to 30 cm. high. **Branchlets** about 24, of two distinct types, a longer whorl 2–3 times furcate, and 2 shorter central accessory whorls. **Dactyls** 4–5, uniformly 2-celled. **Accessory branchlets** of the upper row once furcate into 5 rays; those of the lower row once or twice furcate into 4–6 rays. **Gametangia** borne together at all nodes of the primary branchlets, and occasionally at the nodes of the accessory branchlets, solitary, enveloped in mucus. **Oogonia** (dimensions not given). **Oospores** reddish-brown, 250–335 μ long; **striations** of 6–7 ridges; **membrane** granulate. **Antheridia** 350–425 μ in diameter.⁵⁸

⁵⁶ Allen (1896: 6).

⁵⁷ Certain editions were mistakenly dated 1815 instead of the correct 1805 (cf. Journ. Bot. p. 431. 1896).

⁵⁸ Zaneveld (1940: 108)

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 16).

EXSICCATAE: (cf. var. *Engelmanni*)

DISTRIBUTION FOR NORTH AMERICA: (cf. var. *Engelmanni*)

TYPE LOCALITY: Europe.

The species *Chara hyalina* was first described by DeCandolle in Lamark (1805: 247) based on the specimens cited as "trouvée aux environs de Lausanne, par M. Gay; du Mans, par M. Desportes; de Nantes, par M. Hectot." As discussed under *N. tenuissima*, Desvaux (1818: 14) challenged DeCandolle's name, thinking it a synonym of his species; and Braun (1835: 54) showed DeCandolle's specimens to include both Desvaux's plants and *C. hyalina* (= *N. hyalina*), thus confirming DeCandolle's name in part (*pro parte*). Agardh (1824: 126) transferred the plant to the genus *Nitella*.

Nitella hyalina var. **Engelmanni** Braun

Nitella hyalina var. *Engelmanni* Braun, Abh. k. Akad. Wiss. Berlin (1882): 79. 1883.

Nitella formosa Allen, Bull. Torrey Bot. Club 20: 119. 1893. — *ibid.*, p. 258. (= *N. hyalina*, near var. *Engelmanni*).

LITERATURE FOR NORTH AMERICA:

Nitella hyalina var. *Engelmanni*: Braun, l.c., p. 58. — Allen, l.c., p. 258.

Nitella formosa: Allen, l.c., p. 119.

Nitella hyalina: Allen, Char. Amer. 1: 48 (key). 1888. — Stewart, Journ. Elisha Mitchell Sci. Soc. 53: 175. 1937.

This variety differs from the species in that the whorl consists of larger, twice-divided, or occasionally smaller once-divided, more abundant branchlets.⁵⁹

ILLUSTRATIONS: Stewart (1937: pl. 16–19).

EXSICCATAE: Char. Amer. Exsicc. 44; Phyc. Boreali-Amer., Fasc. E, CI.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Tlalnepantla,⁶⁰ Allen (1893: 119);

United States: — North Carolina, Stewart (1937: 175); — Texas, Braun (1883: 58, 79) (TYPE LOCALITY).

Braun (1883: 79) described this variety based on the specimen cited as "Texas (Lindheimer, Oct. 1845) comm. Engelmann." Allen (1893: 119) described *N. formosa* based on specimens from Mexico, but later (1893: 258) stated that it was to be included with *N. hyalina* and related to var. *Engelmanni*.

20. Nitella Leibergi Allen

Nitella Leibergi Allen, Char. Amer. 2(3): 19. 1896.

LITERATURE FOR NORTH AMERICA:

Nitella Leibergi: Allen, l.c., p. 19, pl. 18.

Plant monoecious, up to 3–4 cm. high, diffusely branched. **Branchlets** 6 in a whorl, frequently heteromorphous, some undivided, some 1–2 times

⁵⁹ Braun (1883: 79).

⁶⁰ Type locality of *N. formosa* Allen.

divided; first branchlet node rarely fertile, the second usually fertile. **Dactyls** usually 4, 2-celled; apical cell a rather elongated mucro, 50 μ in diameter by 135–185 μ long; the penultimate cell generally tapers somewhat from about the middle to the base of the apical cell. **Gametangia** together at the second (rarely the first) branchlet node. **Oogonia** (frequently isolated) 390 μ long; **coronula** small and persistent. **Oospores** averaging 272 μ long by 175–240 μ wide; **striations** of 6 strong ridges; **membrane** marked with fine granules (doubtful, due to immaturity of specimens). **Antheridia** 200–300 μ in diameter.⁶¹

ILLUSTRATIONS: Allen (1896: pl. 18).

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Oregon, Allen (1896: 20) for Button Springs, Lake Co. (TYPE LOCALITY).

The literature for this species is limited to the original description by Allen (1896: 19) based on the specimen cited as “. . . collected for the United States National Herbarium by J. B. Leiberger on June 30, 1894, in ‘shallow pools which dry up in middle summer, under and among the submerged *Artemisia* shrubs, near Button Springs, Lake Co., eastern Oregon. Alt. 1470 meters.’ ”

21. *Nitella capitellata* Braun

(Non) *Chara capitata* Nees von Esenbeck, Denkschr. k. beierisch. bot. Gesell. 2: 80. 1818. (= *N. capillaris* (Krocker) Groves & Bullock-Webster).

Chara capitata Elliott, Sketch of Bot. S. Carolina and Ga. 2: 516. 1824.

Chara capitellata Elliott ex Braun, Amer. Journ. Sci. & Arts 46: 93. 1844. (nom. nud.).

Nitella capitellata Braun, Abh. k. Akad. Wiss. Berlin (1882): 56. 1883.

LITERATURE FOR NORTH AMERICA:

Chara capitata: Elliott, l.c.

Chara capitellata: Braun, l.c.

Nitella capitellata: Braun, l.c. — Allen, Char. Amer. 1: 46 (key). 1888. — *ibid.*, 2(3): 21, 22, pl. 20. 1896.

Plant dioecious or monoecious (unknown). **Sterile branchlets** 6 in a whorl; once divided. **Fertile branchlets** 6 in a whorl, shorter than sterile branchlets; once to three times divided; occasionally forming heads. **Gametangia** borne at first division of fertile branchlets. **Oogonia** solitary, 360–420 μ long, 270–300 μ wide. **Oospores** 230–250 μ long, 190–200 μ wide, dark brown; **striations** of 5 (?) (data taken from Allen's drawing) sharp-angled ridges; **membrane** (unknown). **Antheridia** (unknown).⁶²

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 43–46), Allen (1896: pl. 20).

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Georgia, Elliott (1824: 516) for rice fields on the Ogeechee River (TYPE LOCALITY), Braun (1883: 57), Allen (1896: 21); — Texas, Braun (1883: 58).

⁶¹ Allen (1896: 19).

⁶² Allen (1896: 21).

This species is based upon two plants, and a possible third, as stated by Braun (1883: 56). The original description for the plant by Elliott (1824: 516) for *C. capitata* was based on the specimen cited as "Grows in ditches — common in the rice fields on the Ogeechee River. Flowers April–May."

Braun (1844: 92), not being able to obtain the original description or plant, listed the name *Chara capitellata* Elliott as suggested by Schweinitz through courtesy to Elliott, despite the fact that Elliott's description as a later homonym of *C. capitata* Nees von Esenbeck had no valid status. Prior to this time, Braun had used *Chara tenella* Braun (ined.) to designate this species, and during 1846 employed *C. Ellioti* Braun (ined.). However, in his "Fragmente einer Monographie der Characeen" (1883: 56) he redescribed the plant completely under *Nitella capitellata* Braun.

Braun's species was based on the specimen cited as "... Georgia (gesammelt von Le Conte). Herb. Richard, als *Ch. nidifica*," with collecting data as "Grows in ditches. Common in rice fields on the Ogeechee river, Georgia," quoted from Elliott. He cited also LeConte's specimen in "herb. Zeyher" without locality. A third specimen was cited as in "herb. Martius," sent by L. V. Schweinitz under the name *C. capitellata* Ell. without locality, which was apparently identical to the specimen in "herb. Richard."

22. *Nitella capillata* Braun, spec. dub.*

Nitella capillata Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 893. 1868.

LITERATURE FOR NORTH AMERICA:

Nitella capillata: Braun, l.c. — Abh. k. Akad. Wiss. Berlin (1882): 91, pl. 2, fig. 64–68. 1883. — Allen, Char. Amer. 1: 49 (key). 1888.

Plant monoecious, similar in habit to *N. mucronata* subsp. *virgata* (Wallman) Braun, and *N. myriotricha* Braun (New Holland). **Branchlets** 6 in a whorl. **Sterile branchlets** 35–45 mm. long, 3 (–4) times divided. **Fertile branchlets** 1½–3 mm. long, forming dense heads; whorls 5–6 in a row on a stem, forming short spikes. **Dactyls** (number not given) 3– (rarely 2–) celled; apical cell blunt and short. **Gametangia** borne at all branchlet nodes, antheridia lacking at last division of branchlets. **Oogonia** solitary at all divisions of fertile branchlets, 220–250 μ long, 180–220 μ wide (an immature oogonium); **coronula** short; envelop-

* At the time of preparation of this manuscript, the writer received notice of a paper in press on this species. Mrs. Daily will report specimens collected in abundance by Dr. L. A. Whitford 3, (Univ. N. Carolina) May 24, 1941; No. —, April 19, 1946. In the swift outflow from Partin's Mill Pond, 20 miles south of Raleigh [North Carolina] (F)(FH)(Miss)(NY)(US) and Herb. F. K. Daily. Her more complete description of these plants adds the following information to Braun's original descriptions: dactyls 3, 3–4-celled, blunt to pointed; oogonia solitary, coronulae 16 μ broad, 21 μ long; oospore 221 x 198 μ , striae of 8–9 not prominent ridges; membrane irregularly reticulate, reticulae about 10 m μ in diameter; antheridia long stipitate, up to 318 μ in diameter. Ref.: Daily, F. K. 1948 (in press). *Nitella capillata* A. Br. in North Carolina. Butler Univ. Bot. St. 8: 1948.

ing cells showing 6 convolutions. **Oospores** (no data given, no ripe oospores seen by Braun); **striations** (data not given); **membrane** (data not given). **Antheridia** borne on long stipes (?), occurring at all branchlet nodes except the last; about 200 μ in diameter.⁶³

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 64-68).

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Braun (1883: 92) for New Orleans (TYPE LOCALITY).

The name *capitata* first occurred in the literature with a meager description by Braun (1868: 893). It was described in greater detail by Braun (1883: 91) as a doubtful species based on the specimen cited as "New Orleans; (Riddell, A. Wood dedit 1859)," G. Engelmann 1860 oder 1861 unter dem Namen *Ch. capitata* ein einziges Exemplar."

23. *Nitella annularis* Allen

Nitella annularis Allen, Char. Amer. 2(2): 16. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella annularis: Allen, l.c.

Plant monoecious (?), 15-22 cm. high, branched and forming intricate masses. Nodes of axes and branchlets swollen and thickened, readily fragmenting.⁶⁴ **Sterile branchlets** usually 6 in a whorl; once or twice divided; those toward the center of the axis frequently elongated, even exceeding the axis in length. **Dactyls of sterile branchlets** 2-3, terminated by a crown of 3 elongate, 2-celled terminals including the ultimate mucro (about 200 x 116 μ), and a basal cell (610 x 290 μ). **Fertile branchlets** 6 (?) in a whorl, once divided, into 2-3, 2-celled dactyls, contracted into dense terminal heads, with additional branchlets forming within the whorl. **Dactyls of fertile branchlets** 2-3, 2-celled, including a terminal, sharp-pointed and tapering mucro (early deciduous). **Game-tangia** aggregated and at same node. **Oogonia** aggregate, usually 3 together, apparently on one side of the node; **coronula** evanescent. **Oospore** nearly round, 280 μ long, 260 μ broad; **striations** of 5 ridges; **membrane** minutely granular. **Antheridia** about 520 μ in diameter, somewhat stipitate, persisting after subtending dactyls have excised.⁶⁵

ILLUSTRATIONS: Allen (1894: pl. 17).

EXSICCATAE: None issued. Specimen: [C. G.] Pringle, Oct. 5, 1888. Sierra Madre of W. Chihuahua, Mexico (NY).

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Chihuahua, Allen (1894: 17) for Arroyo Ancho, Sierra Madre of W. Chihuahua (TYPE LOCALITY).

⁶³ Braun (1883: 91).

⁶⁴ Allen suggests that the swollen nodes relate to the manner in which segments of branchlets drop off very early, so that the mucros can be found only on the youngest leaflets, and branchlets drop from axial nodes leaving rings of thickened nodal cells. These rings are the basis for the name *annularis*.

⁶⁵ Allen (1894: 16).

This species was described by Allen (1894: 16) based on the specimen cited as "collected by Mr. Pringle, in a 'cold pool, Arroyo Ancho, Sierra Madre, of W. Chihuahua, October 8, 1888,' in Mexico."

24. *Nitella Morongii* Allen

Nitella Morongii Allen, Bull. Torrey Bot. Club 14: 214. 1887.

LITERATURE FOR NORTH AMERICA:

Nitella Morongii: Allen, l.c., p. 214, pl. 75. — Char. Amer. 1: 7, 44. 1888. — Owen, Pl. Nantucket p. 74. 1888. — Nordstedt, Lunds Univ. Årsskr. 25(4): 9. 1889. — Allen, Char. Amer. 2(2): 9 (key), 15, pl. 16. 1894. — Bull. Torrey Bot. Club 25: 73. 1898.

Plant monoecious, 8–15 cm. high. **Branchlets** about 6 in a whorl. **Sterile branchlets** 1–2 times divided. **Fertile branchlets** 1–2 (rarely 3) times divided, condensed into dense heads 6–8 mm. in diameter; branchlets very short. **Dactyls of sterile branchlets** 1 (–2) –celled and apparently deciduous. **Dactyls of fertile branchlets** (3–) 4, 2-celled; the penultimate cell not inflated; the ultimate cell a mucro 45 μ broad at the base, 140 μ long, tapering to a sharp point. **Gametangia** solitary, on the last branchlet node, not (?) enveloped in mucus. **Oogonia** solitary; **coronula** persistent. **Oospores** 250–260 μ long by 240–245 μ wide; **striations** of 5 prominent ridges; **membrane** minutely granulate or grumous, like felt with knotty fibers. **Antheridia** 170 μ in diameter.⁶⁶

ILLUSTRATIONS: Allen (1894: pl. 16).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXVIII, 1382. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: F. S. Collins, Aug. 23, 1896. In a small pool near Siasconset, Nantucket, Mass. (from the original station). Duplicates were also issued under the title "Characeae Americanae Exsiccatae," apparently in the same manner; i.e., posthumously: T. Morong. Nantucket, Mass.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Allen (1887: 214; 1894: 15), Owen (1888: 74) for Nantucket (TYPE LOCALITY).

This species was described by Allen (1887: 214) from the only known specimens cited as ". . . gathered by the Rev. Thos. Morong, on the Island of Nantucket, in a very muddy pool, July 21st, 1887."

Zaneveld (1940: 70) suggested that *N. Morongii* Allen, along with *N. brachytelea* Braun, *N. subluceus* Allen, and *N. axillaris* Braun, should be united as a variety or a synonym of *N. translucens* (Pers.) Agardh.

25. *Nitella axillaris* Braun

Nitella axillaris Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 356. 1859.

LITERATURE FOR NORTH AMERICA:

Nitella axillaris: Braun, Abh. k. Akad. Wiss. Berlin (1882): 48. 1883. — Allen, Char. Amer. 1: 44 (key). 1888. — ibid. 2(2): 9 (key), 15, pl. 15. 1894. — Bull. Torrey Bot. Club 25: 73. 1898. — Daily, Butler Univ. Bot. St. 6: 154. 1944.

Nitella translucens: Woods, Fl. Nebraska p. 124, pl. 29. 1894. (= *N. axillaris*, fide Daily).

⁶⁶ Allen (1894: 15).

Plant monoecious, 25–45 cm. high, transparent, shiny. Stem stout. Internodes $1\frac{1}{2}$ –4 times the length of the branchlets. **Sterile branchlets** (4–) 6 in a whorl, about 2 mm. long, once furcate; primary rays nearly as long as the entire branchlets; secondary rays (2–) 3 (–4), 2-celled, much abbreviated; basal cell about $75\ \mu$ long by $50\ \mu$ wide; the ultimate cell about $75\ \mu$ long by $30\ \mu$ wide, conical, acuminate. **Fertile branchlets** 4–6 in a whorl, usually 1–2 times furcate; secondary rays 1–3, tertiary rays, if any, (1–) 3 (–4), 2-celled; contracted into dense heads about 3 cm. [mm. ?] in diameter, of which 1–5 are produced in the axils of the whorls of sterile branchlets. **Dactyls** (1–) 3 (–4), 2-celled; basal cell of sterile branchlets tapering into the conical, acuminate ultimate cell; basal dactyl cell of the fertile branchlets rounded at the apex, therefore being proportionally much wider than the more allantoid ultimate cell. The penultimate cells of the fertile dactyls are much larger than in the sterile dactyls. **Gametangia** sessile, aggregated at all free nodes though frequently lacking on the ultimate node; not enveloped in mucus. **Oogonia** solitary or geminate, seldom triple, lateral; enveloping cells generally showing 7 convolutions; **coronula** about $45\ \mu$ high, $30\ \mu$ wide at the base; persistent. **Oospores** light brown, 270 – $300\ \mu$ long x 240 – $300\ \mu$ wide; **striations** of 5–7 ridges; **membrane** reticulate. **Antheridia** 220 – 270 (– 300) μ in diameter.⁶⁷

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 35–38), reprinted in Allen (1894: pl. 15), Woods (1894: pl. 29).

EXSICCATAE: Duplicates have been widely distributed by the New York Botanical Garden: *E. J. Alexander*, Feb. 1935, in an aquarium, New York Botanical Garden, Bronx Park, N. Y. (NY), det. G. O. Allen. [Original source not known ?].

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: —Orizaba, Braun (1883: 48); **United States**: —Nebraska, Woods (1894: 124), Daily (1944: 154).

TYPE LOCALITY: Venezuela, near Caracas.

This species was described by Braun (1859: 356) based on the specimen cited as "In stagnis prope Caracas (im See von Valle) Mart. 1854 legit. J. Gollmer (herb. A. Br.)."

Zaneveld (1940: 70) pointed out that Braun separated this species from *N. translucens* (Pers.) Agardh, on the basis of the length of the oospores and the fertile heads which occur only in the axils and never terminally as in *N. translucens*. Zaneveld expressed his doubt as to the necessity of this distinct species, and proposed to unite *N. axillaris* Braun, *N. Morongii* Allen, *N. sublucens* Allen, and *N. brachyteles* Braun as entities of the original *N. translucens*.

26. *Nitella oligospira* Braun

Nitella oligospira Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 357. 1859.

LITERATURE FOR NORTH AMERICA:

Nitella oligospira: Allen, Char. Amer. 1: 47 (key). 1888. — (cf. var. *Wrightii*).

⁶⁷ Zaneveld (1940: 69), supplemented from Daily (1944: 154)

Plant monoecious, grayish to bright green, lax, about 25 cm. high. Stem rather slender to moderately stout. Internodes 0.5–3 times the length of the branchlets. **Sterile branchlets** 6–7 in a whorl, about 1.5 cm. long, rigid and spreading, (2–) 3 (–4) times furcate; primary rays $\frac{1}{2}$ – $\frac{1}{3}$ as long as the entire branchlet; secondary rays 4–5; tertiary rays 2–3, of which 1–2 are again forked with 1–3 quaternary rays. **Fertile branchlets** 5–7 in a whorl, tufted, 2.5–3 cm. long, 4 (–5) times furcate; primary rays $\frac{1}{3}$ the length of the branchlets; secondary rays 5–7; tertiary rays 3–4, most of them again furcate into 2–3 quaternary rays; sometimes 1–2 of these give rise to 1–2 quinary rays. **Dactyls** 1–3, 2-celled, varying in length, some are short and others very long; lower cell cylindrical but variable in length, rounded or truncate at the apex; ultimate cell conical, acuminate. **Gametangia** sessile, at all free branchlet nodes except occasionally the ultimate nodes; not enveloped in mucus. **Oogonia** solitary, lateral, 384–560 μ long, 365–460 μ wide; enveloping cells showing 7–8 convolutions; **coronula** 30–40 μ high, 27–38 μ wide at base, persistent, the cells of both tiers equal in length. **Oospores** light brown, 260–400 μ long, 215–365 μ wide; **striations** of 6–7 broad ridges; **membrane** reticulate. **Antheridia** terminal, 208–310 μ in diameter.⁶⁸

ILLUSTRATIONS: (cf. varieties)

EXSICCATAE: (cf. varieties)

DISTRIBUTION FOR NORTH AMERICA: (cf. varieties)

TYPE LOCALITY: Venezuela, near Caracas.

This species has been accepted in the literature since its first publication by Braun (1859: 357) based on the specimen cited as "In stagnis prope Caracas (Lagune von Valle) Mart. 1856 1. J. Gollmer."

Nitella oligospira var. *Salzmänniana* Braun (?) var. dub.

Nitella oligospira var. *Salzmänniana* Braun, Abh. k. Akad. Wiss. Berlin (1882): 70 (sine descr.), 206 (as var.) in explanation of plates, pl. 2, fig. 50–52. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella oligospira var. *Salzmänniana*: Braun, l.c.

To date, the writer has been unable to locate any published data or specimens upon which a description could be based.

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 50–52).

EXSICCATAE: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: (?). (cf. text).

TYPE LOCALITY: ?

The writer has been unable to locate any literature on this variety other than Braun's (1883) notes and figures. Since he states that the specimen was collected by Gollmer, it is suspected that the material was collected in South America. However, the information is discussed under the heading

⁶⁸ Zaneveld (1940: 83).

for North America. For this reason, the variety is entered in this paper with reservations.

The name *Nitella oligospira* (var.) *Salzmänniana* appeared in Braun's (1883: 70) works without description, but was accompanied by detailed figures of the dactyls. In accordance with Art. 44 of the "International Rules of Botanical Nomenclature," prior to January 1, 1908, a name published with figures accompanied by analyses, constitutes a validly published name. The writer strongly doubts that the information can be construed to form a suitable analysis, and awaits the location of the original specimen.

***Nitella oligospira* var. *Wrightii* Braun**

Nitella oligospira var. *Wrightii* Braun, Abh. k. Akad. Wiss. Berlin (1882): 70. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella (Tolypella) intricata: Halsted (pro parte), Proc. Boston Soc. Nat. Hist. 20: 178. 1879, and Robinson, Fl. Essex Co., Mass. p. 147. 1880. (= *N. oligospira* var. *Wrightii*, fide Braun (1883: 70); cf. also *N. microcarpa* subsp. *megacarpa*).

Nitella oligospira var. *Wrightii*: Braun, l.c. — Allen, Char. Amer. 2(3): 20. 1896.

This variety differs from the species especially in the larger size of the antheridia, 300–310 μ in diameter.⁶⁹

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 53–55).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. E, CIII. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: P. Allen, Aug. 1882. Saranac Lake, N. Y. (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Texas, Halsted (1879: 178), Braun (1883: 70) and Allen (1896: 20) for West Texas and near New Braunfels (TYPE LOCALITIES).

This variety was described by Braun (1883: 70) based on specimens cited as "In the Leona, running water, West Texas (Mexican Boundary Juli 1851 *Ch. Wright*.)" and "In the Comale (Bach bei Neubraunfels nach Engelmann) clear running water, Texas (coll. 1850 *Ch. Wright*)." Apparently no further studies for this variety have been reported in the literature.

27. *Nitella microcarpa* Braun

Nitella microcarpa Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 357. 1859.

LITERATURE FOR NORTH AMERICA:

Nitella microcarpa: Braun, Abh. k. Akad. Wiss. Berlin (1882): 71, pl. 2, fig. 56–59. 1883. — Allen in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889. — (cf. also under varieties and subspecies).

Plant monoecious, dark brownish-green, up to 25 cm. high. Stem moderately stout to slender, 500–1100 μ in diameter. Upper internodes $\frac{1}{2}$ –1 times as long as the branchlets. Lower internodes usually somewhat longer than the upper internodes. **Sterile branchlets** 6 in a whorl, up to 4 cm.

⁶⁹ Braun (1883: 70).

long, 2-3 times furcate; primary rays 4-6; tertiary 2-4, of which usually 1-3 are again furcate into 1-3 quaternary rays. **Fertile branchlets** 6 in a whorl, 1.5-2 cm. long, 3-4 times furcate, much condensed; primary rays $\frac{1}{3}$ - $\frac{1}{2}$ the length of the entire branchlet; secondary rays 4-6; tertiary rays 3-5, of which 1-2 are again forked into 2-3 quaternary rays; quinary rays, if any, 1-3. **Dactyls** 1-3, usually 2-celled, but often 3-celled, occurring especially in the sterile branchlets; penultimate cell varying up to 1000 μ , 55-120 μ wide; ultimate cell conical, 60-150 μ long, 20-90 μ wide at base. **Gametangia** frequently together at all nodes of fertile branchlets except the ultimate node which is generally sterile; not enveloped in mucus. **Oogonia** sessile, lateral, frequently 2-4 (-more) together around one antheridium; 250-530 μ long, 210-415 μ wide; enveloping cells showing 7-8 convolutions; **coronula** 30-80 μ high, 45-100 μ wide at base, persistent, both tiers of cells equal in length. **Oospores** golden-brown, 180-450 μ long, 225-450 μ wide; **striations** of 6 sharp ridges; **membrane** reticulate. **Antheridia** sessile, solitary, terminal, 180-290 (-400 in subspecies *megacarpa*) μ in diameter.⁷⁰

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 56-59).

EXSICCATAE: (cf. under subspecies and varieties)

DISTRIBUTION FOR NORTH AMERICA: **Canada**: — Quebec, Montreal, Braun (1883: 71). (cf. also under varieties)

TYPE LOCALITY: Paramaribo, Dutch Guiana, and "near Panama."

The name *Nitella microcarpa* was first employed by Braun (1859: 357) in the description based on the specimen cited as "Circa Paramaribo Guyanae hollandicae 1827 detexit Weigelt; prope Panama 1846 eandem legit Duchassaing (herb. Kunze, Hooker, Lenormand, A. Br. etc.)."

The group of names which Zaneveld (1940: 101) chose to assemble as synonyms under this species includes a number of very confusing forms, such as *N. Glaziovii*, *N. microglochin*, *N. polyglochin*, and a number of subspecific forms. These are particularly pertinent to a study of the species of North America, which has a rather good representation of such forms. These are treated in greater detail under each variety or subspecies below.

Nitella microcarpa var. **Drummondii** Braun

Nitella microcarpa var. *Drummondii* Braun, Abh. k. Akad. Wiss. Berlin (1882): 72. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella microcarpa var. *Drummondii*: Braun, l.c., p. 72, pl. 2, fig. 58, 59.

This variety is characterized by the extreme length of the primary branchlet rays which exceed the rest of the branchlet in length; by the dactyls which, though thick and bushy as in the species, are shorter than in the species; by the secondary rays which are frequently 6 and give the appearance of a branchlet whorl formed at the first branchlet node;

⁷⁰ Zaneveld (1940: 101).

by the ultimate cell of the dactyls which is equal in length to the penultimate cell instead of exceeding it as in the species; by the oogonia which are 2–4 together and smaller than in the species (250–260 μ long, 210 μ wide).⁷¹

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 58, 59).

EXSICCATAE: None. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Braun (1883: 72) for New Orleans (TYPE LOCALITY).

This variety was described by Braun (1883: 72) based on the specimen cited as "Nord-Amerika. New-Orleans (Drummond; N. J. Winch's foreign herbarium in Linnean Society, London)."

***Nitella microcarpa* var. *Glaziovii* (Zeller) Zaneveld**

Nitella Glaziovii Zeller, Symb. ad Fl. Brasiliae Centr. Cognosc. 22: 428. 1876.

Nitella microcarpa var. *Glaziovii* Zaneveld, Blumea 4: 104. 1940.

LITERATURE FOR NORTH AMERICA:

Nitella Glaziovii: Allen in Mohr, Contrib. U. S. Nat. Herb. 6: 147. 1901.

Nitella microcarpa (subsp. or var.) *Glaziovii*: Allen, Char. Amer. 1: 47 (key). 1888. — Bull. Torrey Bot. Club 21: 525. 1894.

Plant stout. Stem up to 1100 μ in diameter. Dactyls varying much in length, frequently one or two dactyls much longer than the others; sometimes all much elongated or abbreviated; 2 (–3)-celled; penultimate cell up to 1000 μ long, and 120 μ in diameter; ultimate cell conical, up to 150 μ long, and 90 μ in diameter. Gametangia occurring at the ultimate branchlet node only if one or more of the dactyls are elongated. Oogonia 415–475 μ long (including the coronula), 300–325 μ wide. Oospores 240–280 μ long, 220–250 μ wide; striations (no data given); membrane (no data given). Antheridia (no data given).⁷²

ILLUSTRATIONS: None.

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *J. W. Blankinship*. Springfield, Missouri. Other specimens were also issued with the label title "Characeae Americanae Exsiccatae."

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Alabama, Allen in Mohr (1901: 147).

TYPE LOCALITY: Rio de Janeiro, Brazil.

This species was first described by Zeller (1876: 428) as *Nitella Glaziovii* based on the specimen cited as "Gavia ad Rio de Janeiro. (5449). (Inter Characeas etiam commemoranda est sec. Kützing sp. alg. p. 518 'Nitella clavata Kg.' quam in Brasilia collegit Sellow)."

Nordstedt in Braun (1883: 72) reduced the species to the subspecies *N. microcarpa* subsp. *Glaziovii* (Zeller) Nordst., and emended the de-

⁷¹ Braun (1883: 72).

⁷² Zaneveld (1940: 104).

scription. Zaneveld (1940: 104) reduced it to the varietal status as it appears in the present work.

Nitella microcarpa subsp. **megacarpa** (Allen) Nordstedt

Nitella megacarpa Allen, Char. Amer. Exsicc. 3. 1880. (descr.).

? *Nitella polyglochin* subsp. *megacarpa* Allen, l.c. in descr. (nom. ambig.).

Nitella microcarpa subsp. *megacarpa* Nordstedt *apud* Braun, Abh. k. Akad. Wiss. Berlin (1882): 73. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella intricata: Halsted, Proc. Boston Soc. Nat. Hist. 20: 178. 1879, and Robinson, Fl. Essex Co., Mass. p. 147. 1880. (in part, fide Nordst. in Braun (1883: 73)); (cf. also *N. oligospora* var. *Wrightii*).

? *Nitella macrocarpa*: Allen in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889.

Nitella megacarpa: Allen, l.c. — Bull. Nat. Hist. Soc. New Brunswick 1^a: 15 (fossil). 1883. — Char. Amer. 1: 6, 28 (fig. 36). 1888. — Nordstedt, Lunds Univ. Årsskr. 25(4): 12. 1889.

? *Nitella microcarpa*: Allen in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889.

Nitella microcarpa subsp. *megacarpa*: Nordstedt in Braun, l.c. — Allen, Char. Amer. 1: 47 (key). 1888. — Bull. Torrey Bot. Club 21: 525. 1894.

Nitella microcarpa var. *megacarpa*: Groves, H. & J., in Urban, Symb. Antill. 7(1): 37. 1911. — Zaneveld, Blumea 4: 102. 1940.

Nitella polyglochin: Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (fide Wood, Ohio Journ. Sci. 47: 248. 1947).

Nitella polyglochin var. *megacarpa*: Allen, l.c. — Char. Amer. 1: 8. 1888.

Nitella polyglochin subsp. *megacarpa*: Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888.

? *Nitella polyglochin* var. *microcarpa*: Allen, Bull. Torrey Bot. Club 2(3): 9. 1871.

This subspecies differs from the species primarily in the greatly enlarged sex organs: oospores 440–530 μ long, antheridia about 400 μ in diameter.⁷³

ILLUSTRATIONS: Wood (1947: pl. 1, fig. 4a–e).

EXSICCATAE: Char. Amer. Exsicc. 3; Phyc. Boreali-Amer., Fasc. E, CII, Fasc. XXXII, 1588. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: Robinson, Aug. 1880. Boxford, Mass.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Connecticut, Allen (1880: No. 3, exsicc.) for "Bantam Lake" (TYPE LOCALITY); — Massachusetts, Halsted (1879: 178) as *N. intricata*, Nordstedt in Braun (1883: 73), Dame & Collins (1888: 151); — New Jersey, Allen in Britton (1889: 356).

Allen's treatment of this entity is very confusing throughout his writings, because he failed to decide upon what disposition to make of the plant. His original description (1880: No. 3, exsicc.), and apparently the only description that exists for the subspecies, appears on the label of his exsiccata specimen No. 3, with the collection data "Habitat: 'Bantam Lake,' Litchfield, Conn., (T.F.A.); Boxford, Mass., (John Robinson). Coll.: T. F. Allen, August, 1880." The label states clearly that the name *N. megacarpa* Allen is being described; but in the diagnosis the statement "Sub-species *N. polyglochin*, A. Br. sensu latiore." is very ambiguous, as one is left

⁷³ Allen, Char. Amer. Exsicc. 3.

undecided whether Allen meant the new form to be a species or a subspecies. If Allen meant *N. polyglochin* Braun *sensu latiore* to indicate a subgeneric section of *Nitella* as he employed it later (1888: 47), *N. polyglochin* Braun, in its broadest sense (= brachydactylae), then *N. megacarpa* could be construed to have been intended as a full species. In later writings, Allen referred to this plant under *N. microcarpa*, *N. megacarpa*, *N. polyglochin*, and various subspecific forms of these species.

Zaneveld (1940: 103) included *N. polyglochin* Braun *sens. lat.* under his new combination *N. microcarpa* var. *microglochin*; and it appears probable that this is a more consistent disposition. Further monographic study of the American forms is greatly needed in this group.

28. *Nitella transilis* Allen

Nitella tenuissima forma *longifolia elongata* Allen, Char. Amer. Exsicc. 31. 1888. (nom. nud.).

Nitella tenuissima forma *longifolia* Allen, Char. Amer. 1: 7. 1888. (nom. nud.).

Nitella transilis Allen, Char. Amer. 2(3): 24. 1896.

LITERATURE FOR NORTH AMERICA:

Nitella tenuissima forma *longifolia*: Allen, l.c.

Nitella tenuissima var. *longifolia*: Allen, l.c.

Nitella transilis: Allen, l.c. — Bull. Torrey Bot. Club 25: 77. 1898. — Burnham and Latham, Torreya 23: 4. 1923. — Grier, Amer. Midl. Nat. 9: 60. 1924-5.

Plant monoecious, 5-10 cm. high, rarely branched. Stem slender. **Branchlets** 5-6 in a whorl, 3-4 times furcate; secondary rays 6. **Dactyls** 3-4, 2-celled, the ultimate cell a mucro 60-70 μ long. **Gametangia** isolated at the second (rarely the third) node of the branchlets. **Oogonia** isolated. **Oospores** 272-285 μ long, 245-265 μ wide; **striations** showing 7-8 prominent ridges; **membrane** reticulate to smooth. **Antheridia** (dimensions not given).⁷⁵

ILLUSTRATIONS: Allen (1896: pl. 23).

EXSICCATAE: Char. Amer. Exsicc. 31. sub. nom. *N. tenuissima* f. *longifolia elongata*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *T. F. Allen*. Sparta, New Jersey.

DISTRIBUTION FOR NORTH AMERICA: **United States:** — Massachusetts, Allen (1896: 24); — New Jersey, Allen (1896: 24); — New York, Burnham & Latham (1923: 4), Grier (1924-5: 60); — Rhode Island, Allen (1896: 24).

TYPE LOCALITY: (?).

This species was described by Allen (1896: 24) based on the exsiccata specimen No. 31 of Characeae Americanae Exsiccatae. Allen (1888: 7) referred to this specimen as f. *longifolia*, and (1896: 24) as var. *longifolia*. Apparently no monographic works have treated this species since it was described.

29. *Nitella tenuissima* (Desv.) Kützing

Chara tenuissima Desvaux, Journ. de Bot. 2: 313. 1809.

Nitella tenuissima Kützing, Phyc. Gen. p. 319. 1843.

⁷⁵ Allen (1896: 24).

LITERATURE FOR NORTH AMERICA:

Chara tenuissima var. *americana*: Braun in Engelmann and Gray, Boston Journ. Nat. Hist. 5: 264. 1845. (nom. nud.).

Nitella tenuissima: Wallman, K. Vets.-Akad. Handl. (1852): 246. 1854. — Allen, Bull. Torrey Bot. Club 2(3): 9. 1871. — Halsted, Proc. Boston Soc. Nat. Hist. 20: 177. 1879. — Allen, Char. Amer. 2: 6, 13, pl. 6. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 62. 1883. — Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888. — Allen, Char. Amer. 1: 46 (key). 1888. — in Bennett, Pl. Rhode I. p. 58. 1888. — in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889. — Nordstedt, Lunds Univ. Årsskr. 25(4): 10. 1889. — Allen, Char. Amer. 2(3): 19 (key), 24, pl. 22. 1896. — Groves, H. & J., in Urban, Symb. Antill. 7: 34. 1911. — Taylor, Rhodora 23: 67. 1921.

Nitella tenuissima var. *americana*: Allen, Char. Amer. 1: 6 (descr.). 1880 (= ? *N. tenuissima*, cf. text).

Nitella batrachosperma: Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (= *N. tenuissima*, fide Wood⁷⁰).

Plant monoecious. **Branchlets** 6 in a whorl, 3–4 times divided; primary rays 1/3–2/5 the entire length of the branchlet. **Dactyls** 3–4, regularly 2-celled; the penultimate cell tapering toward the apical cell so as to be nearly equal in diameter to the base of the mucro; mucro elongate, and narrowly acuminate. **Gametangia** occurring frequently together, at the second and third branchlet nodes (not at the first). **Oogonia** solitary, 400 μ long by 260 μ wide; **coronula** persistent. **Oospores** conspicuously flattened, about 200–250 μ long, 175–200 μ wide, and 100–130 μ thick; **striations** of 7–8, fine, but well-defined, low ridges; **membrane** strongly reticulate with beaded reticulation threads. **Antheridia** about 175 μ in diameter.⁷⁷

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 5, fig. 3–5; pl. 14), Allen (1896: pl. 22).

EXSICCATAE: Char. Amer. Exsicc. 1; Phyc. Boreali-Amer., Fasc. XVII, 821, Fasc. XXXI, 1534. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: P. V. LeRoy, Peeksville, New York; Francis Wolle, New Jersey; J. W. Blankinship, June 1, 1893. In stagnant pool near Uncle Sam Mountain, Lake Co., Calif.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Florida, Allen (1880: 6); — Maine, Taylor (1921: 67); — Massachusetts, Wallman (1854: 246), Allen (1880: 13), Braun (1883: 62), Dame and Collins (1888: 151), Nordstedt (1889: 10); — Michigan, Halsted (1879: 178), Allen (1880: 13), Braun (1883: 62); — New Jersey, Allen (1880: 6), Allen in Britton (1889: 356); — New York, Allen (1880: 13; 1896: 24); — Ohio, Pieters (1901: 78); — Rhode Island, Halsted (1879: 178), Allen (1880: 13), Allen in Bennett (1888: 58).

TYPE LOCALITY: Europe.

The first occurrence of the name *Chara tenuissima* in the literature was the description by Desvaux (1809: 313) based on the specimen cited (Desvaux, 1810: 136, cf. below) as collected by "M. Desvaux. . . pendant le mois de Juin, dans les ruisseaux d'une fontaine aux environs de Poitier." However, as this reference occurred in a rather obscure jour-

⁷⁰ Wood, Ohio Journ. Sci. 47: 246. 1947.

⁷⁷ Groves & Bullock-Webster (1920: 121).

nal, most students consider the first publication as by Desvaux (1810: 136) in Loiseleur-Deslongchamps, Notice sur les Plantes à ajouter à la Flore de France.

In 1805,⁷⁸ DeCandolle (1805: 247) described *Chara hyalina*. Desvaux (1818: 45) reported that DeCandolle's plant was identical to his *C. tenuissima*, and, as he thought that DeCandolle's publication was of a date later than his work of 1809, stated that DeCandolle's name was invalid. If Desvaux had been right in stating that DeCandolle's plant was identical to his, he would still have been wrong in assuming his name had priority. It remained for Braun (1835: 54) to actually compare the plants of both workers, and decide that DeCandolle's material included both *C. tenuissima* Desv. and *C. hyalina* DC. Thus, both *C. hyalina* DC. pro parte and *C. tenuissima* Desv. proved to be valid and good species.

Braun (1845: 264) listed *C. tenuissima* var. *americana* for the United States, but without description. Allen (1880: 6) described *Nitella tenuissima* var. *americana* based on Braun's record. His description was quoted as follows: "Whorls less densely glomerate, but more approximate than in the European form." However, as both men dropped this usage in later works, it is assumed that both authors concluded that the distinctions between the American and European forms of *N. tenuissima* were insignificant. This name did not appear either in Braun's "Fragmente einer Monographie der Characeen" (1883) or in Allen's "Characeae of America" (1892-1896). The writer considers the variety as doubtful.

***Nitella tenuissima* var. *compacta* Braun**

Nitella tenuissima var. *compacta* Braun, Abh. k. Akad. Wiss. Berlin (1882): 62. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella tenuissima var. *compacta*: Braun, l.c.—Allen, Char. Amer. 2(3): 25. 1896.

This variety is distinguished by its minute size, 4-5 cm. high; and thick, compact branchlets.

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 14, fig. 2), Allen (1896: pl. 22, fig. 2).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**:—California⁷⁹ (?), Braun (1883: 62);—New Mexico, Braun (1883: 62) (TYPE LOCALITY ?);—Texas, Braun (1883: 62), Allen (1896: 25).

This variety was described by Braun (1883: 62) from material collected in New Mexico, Texas, and California, cited as "C. Wright, Coll. N. Mex. 1851 no. 86 (comm. Engelmann 1853). Dieselbe von Lindheimer in Texas (in clear springs and creeks near Millcreek west of Brazos)

⁷⁸ DeCandolle in Lamark, Flore Francaise, 6 (1805). Certain editions were mistakenly dated 1815 instead of the correct 1805 (cf. Journ. Bot. p. 431. 1896).

⁷⁹ Braun's original text gave "Monterey, in Nord-Mexico" to which Nordstedt inserted "California."

gesammelt 1844 und von Engelmann mitgetheilt. . . . Monterey in Nord-Mexico (California) Dr. Gregg 1847; von Engelmann erhalten Jan. 1849."

Apparently no further monographic work has treated this form, though Groves and Bullock-Webster (1920: pl. 14, fig. 2) illustrate the same entity but do not employ the formal Latin name for their "compact form."

30. *Nitella mucronata* (Braun) Miquel

(Non) *Chara furcata* Roxburgh apud Bruzelius, Obs. in Genus Charae p. 22. 1824. (= *N. furcata* (Roxb. ap. Bruz.) Agardh, Syst. Alg. p. 124. 1824).

Chara furcata Barbieri ex Amici, Descriz. alc. sp. nuove, p. 14. 1827.

Chara mucronata Braun, Ann. Sci. Nat. 1²: 351. 1834.

Nitella mucronata Miquel in van Hall, Fl. Belg. Septentrionalis 2: 428. 1840.

Nitella mucronata Braun, Neue Denkschr. schweiz. Gesell. Naturw. 10(3): 9. 1847.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata: Kützing, Spec. Alg. p. 514. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 253. 1854. — Allen, Bull. Torrey Bot. Club 2(3): 10. 1871. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 51. 1883. — Allen, Char. Amer. 1: 44 (key), 45 (key). 1888. — Owen, Pl. Nantucket, p. 74. 1888. — Webber, Trans. Acad. Sci. St. Louis 6: 20. 1892. — Woods, Fl. Nebraska, p. 124. 1894. — Allen, Char. Amer. 2(3): 19 (key), 20, 21, pl. 19. 1896. — (cf. also under subspp. *virgata*).

Plant monoecious, stout. Internodes 1–2 times the length of the branchlets. **Branchlets** 5–6 in a whorl, rather stout; sterile and fertile branchlets similar; 1–3 times divided; primary rays about 2/5–2/3 the length of the entire branchlet. **Dactyls** 2–3, 2 (–3)-celled; apical cell a short, conical mucro. **Gametangia** borne at each division of the branchlets. **Oogonia** solitary or geminate, 550–575 μ long, by about 400 μ wide; enveloping cells elongated in maturity (not swelling). **Oospores** dark brown, 300–350 μ long, 250–300 μ wide, 200 μ thick; **striations** of 6–7 thin, prominent ridges; **membrane** reticulate. **Antheridia** about 275 μ in diameter.⁸⁰

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 5, pl. 12), Braun (1883: pl. 1, fig. 39–42, pl. 5, fig. 130), Woods (1894: pl. 28), Allen (1896: pl. 19).

EXSICCATAE: One series was issued as *N. mucronata* without designating the sub-specific group as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *George E. Stone*. 1890. Worcester, Mass.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Georgia, Allen (1896: 20); — Massachusetts, Allen (1896: 21); — Nebraska, Webber (1892: 20), Woods (1894: 124); — New Mexico, Allen (1896: 21); — Oregon, Allen (1896: 21); — Virginia, Braun (1883: 51).

TYPE LOCALITY: Europe.

This plant seems to have been first described by Amici (1827: 14) under the name *Chara furcata*. This is a later homonym of *C. furcata* Roxburgh apud Bruzelius (1824: 22) (= *Nitella furcata* (Roxb. ap. Bruz.) Agardh (1824: 124)). Braun (1834: 351) redescribed the same entity under the name *C. mucronata*. Most of the Characean students of

⁸⁰ Groves & Bullock-Webster (1920: 114).

the last century have credited either Braun (1847: 9) or Kützing (1845: 256) with having transferred the species to the genus *Nitella*. Groves and Bullock-Webster (1920: 113) seem to have been the first to recognize that this had been done some five years earlier by Miquel *in van Hall* (1840: 428).

Little difficulty was experienced with this species during the 19th century until, as a result of finer distinctions in species delimitation, Braun introduced the concept of "broad and strict sense" of the species (*sens. lat.* and *sens. strict.*). In Allen's (1888: 44) synopsis we find these two concepts employed in translating and modifying Nordstedt's synopsis which appeared in Braun's "Fragmente einer Monographie der Characeen" (1883: 8). In later works, Allen raised *N. mucronata*, *sens. lat.*, to a subgeneric section which he called the "Mucronatae," corresponding to other sections such as "Acuminatae" for *N. acuminata*, *sens. lat.*, Braun. Had Allen completed his monograph, the numerous existing subspecific entities of *N. mucronata*, *sens. lat.*, would doubtlessly have been raised to specific rank, and *N. mucronata*, *sens. strict.*, would then have been redefined as *N. mucronata* (*emend.*) of equal status with the new species. Allen did complete this for the "Acuminatae"; but, as the Arthrodactylae were not completed, the present classification for *N. mucronata* for North America is not at all consistent with that for the Anarthrodactylae. In the present paper, the writer has dropped Allen's treatment of both sections as far as is consistent with the objective of the problem, and has attempted to follow the latest monographs for both troublesome series.

***Nitella mucronata* subsp. *virgata* (Wallman) Braun**

Nitella virgata Wallman, K. Vets.-Akad. Handl. (1852): 249. 1854.

Nitella mucronata subsp. *virgata* Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 884. 1868.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata subsp. *virgata*: Allen, Char. Amer. 1: 45 (key). 1888. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 51. 1883. (cf. under varieties).

Plant monoecious, about 20–40 cm. high, strong and erect, freely branching. Branchlets 6 in a whorl, 2–3 times divided. Dactyls (number not given), 2 (–3)-celled; the apical cell a slender mucro; penultimate cell not tapering toward the apex, being 3–8 times as broad as the base of the apical mucronate cell. Gametangia occurring at all branchlet nodes, not enveloped in mucus. Oogonia usually solitary, rarely aggregated. Oospores dark brown or nearly black, 260–360 μ long; striations of 7 rather prominent sharp ridges; membrane reticulate. Antheridia (cf. under varieties).⁶¹

ILLUSTRATIONS: (cf. under varieties).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: (cf. under species and varieties).

⁶¹ Allen (1896: 20).

The name *virgata* first appeared in the literature for the genus *Nitella* in Wallman's (1854: 249) description of *N. virgata* based on the specimen cited as "Frankrike, Paris. Brongniart!" and "Ch. flexilis virgata *Al. Braun!* (in herb. *Ag.*).". Braun (1868: 884) was apparently the first writer to transfer *virgata* to a subspecies status.

As indicated under the discussion for *N. mucronata*, Allen's monographic work did not include this subspecies. For that reason, the literature for North America is very confused. This confusion stems largely from Braun (1883) or from Nordstedt's editing of Braun's manuscripts. Whichever is the case, the fact remains that the arrangement of subspecific forms which appears in this work is rather ambiguous. In Allen's works, this confusion is continued and magnified somewhat through the inconsistent usage of Braun's nomenclature.

Migula (1897: 153) reported his morphologic and culture investigations of the various forms of this species, and concluded that the only forms worth maintaining were subspecies *Wahlbergiana* (Wallman) Braun (1883: 51) and *virgata* (Wallman) Braun. Migula, in fact, seemed to indicate that these subspecies could well be maintained as separate species. Groves and Bullock-Webster (1920: 116) accepted Braun's treatment of these two as subspecies, and accepted var. *tenuior* Braun ex Rabenhorst (1863: 286) and var. *heteromorpha* Kützing (1845: 514). Zaneveld (1940: 97) followed much the same pattern, but accepted also var. *leiopyrena* Braun (1883: 54).

In the present work, the writer has followed Migula (1897: 157), Groves and Bullock-Webster (1920: 116), and Braun (1883: 51) in allocating all the forms of *N. mucronata* to the subspecies *N. mucronata* subspecies *virgata*.

***Nitella mucronata* subsp. *virgata* var. *leiopyrena* (Braun) Allen**

Nitella mucronata subsp. *virgata* var. *pachygyra* forma *leiopyrena* Braun, Abh. k. Akad. Wiss. Berlin (1882): 54. 1883.

Nitella mucronata var. *leiopyrena* Allen, Char. Amer. 2(3): 21. 1896.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata subsp. *leiopyrena*: Allen, Char. Amer. 1: 45 (key). 1888.

Nitella mucronata var. *leiopyrena*: Allen, Char. Amer. 2(3): 21. 1896.

Nitella mucronata subsp. *virgata* var. *pachygyra* forma *leiopyrena*: Braun, l.c.

This variety is characterized especially by the smooth oospores without prominent striations.

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 42).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Sierra Madre, N. W. of Mexico [City?], Braun (1883: 54); **United States**: — Virginia, Braun (1883: 54) for near Orange, Allen (1896: 21). Braun's two localities form the TYPE LOCALITIES.

The form was originally described by Braun (1883: 54) based on specimens cited as "Virginia ad paludem prope Orange' (leg. Carl Beyrich, von ihm als 'foliosa' bezeichnet). Sierra Madri N. W. of Mexico (leg. B. Seemann no. 1964; vidi in herb. Hooker 1853)."

Nitella mucronata subsp. **virgata** var. **pachygyra** Braun

Nitella mucronata subsp. *virgata* var. *pachygyra* Braun, Abh. k. Akad. Wiss. Berlin (1882): 53. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata var. *pachygyra*: Allen, Char. Amer. 2(3): 20. 1896.

Nitella mucronata subsp. *virgata* var. *pachygyra*: Braun, l.c.

This variety is characterized especially by the strongly prominent, thick striations of the oospores.

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 39–41 ?).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Mexican boundary [of Texas], Braun (1883: 53); **United States**: — New Mexico, Braun (1883: 53); — North Carolina, Braun (1883: 53); — Texas, Braun (1883: 53).

TYPE LOCALITY: New Mexico, Coppermine Creek, and Texas, Comale Creek.

The variety was described by Braun (1883: 53) based on specimens cited as "(C. Wright 1851–1852) com. Engelmann, sub lit. I. et L. (Coppermine Creek) 908 et N. (Leona; f. steril). In the Comale, Texas (Wright 1850) f. steril."

Nitella mucronata subsp. **virgata** var. **robustior** (Braun) Dame & Collins

Nitella mucronata a *robustior* Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 882. 1868.

Nitella mucronata var. *robustior* (forma *longifurca*) Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata subsp. *virgata* a *robustior*: Braun, Abh. k. Akad. Wiss. Berlin (1882): 52. 1883.

Nitella mucronata var. *robustior* (forma *longifurca*): Dame and Collins, l.c.

Nitella mucronata forma *robustior*: Allen, Char. Amer. 1: 45 (key). 1888.

This variety is characterized by the very long forked lower branchlets.

ILLUSTRATIONS: None.

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Braun (1883: 52), Dame and Collins (1888: 151).

TYPE LOCALITY: Europe.

This variety was described by Braun (1868: 882) based upon the specimen in Rabenh. Char. Exsiccatae No. 30, and *C. furcata* Barbieri ex Amici and *N. mucronata* Kütz., Phyc. Germ. p. 256, were cited as synonyms.

Nitella mucronata subsp. **virgata** var. **tenuior** Braun ex Crépin

Nitella mucronata β *tenuior* Braun ex Rabenhorst, Krypt.- Fl. Sachsen 1: 286. 1863.⁸²

Nitella mucronata var. *tenuior* Braun ex Crépin, Bull. Soc. Roy. Bot. Belg. 2: 128. 1863.⁸²

⁸² The writer has been unable to establish proof of priority between these two publications.

Nitella mucronata subsp. *virgata* β *tenuior* Braun, Abh. k. Akad. Wiss. Berlin (1882): 53. 1883.

Nitella mucronata subsp. *virgata* var. *tenuior* Dame & Collins, Fl. Middlesex Co., Mass. p. 151. 1888.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata var. *tenuior*: Allen, Char. Amer. 2(3): 21. 1896.

Nitella mucronata forma *tenuior*: Allen, Char. Amer. 1: 45 (key). 1888. — in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889.

Nitella mucronata subsp. *virgata* var. *tenuior*: Dame & Collins, l.c.

Nitella mucronata subsp. *virgata* β *tenuior*: Braun, l.c.

This variety is characterized especially by very small size, stems 500–660 μ in diameter, sterile branchlets 150–300 μ or less in diameter; oospores 280–330 μ long.⁸³

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 39–41 [?]).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Braun (1883: 53), Dame & Collins (1888: 151); — New Jersey, Allen in Britton (1889: 356); — Texas, Braun (1883: 53).

TYPE LOCALITY: Europe.

Braun's form *tenuior* of *N. mucronata* appears to have been described as a variety by Crépin and presumably as a form (β *tenuior*) by Rabenhorst, both of which appeared in 1863. Braun (1867: 2)⁸⁴ employed this designation as a subspecies, but later (1883: 53) reduced it again to a form. Filarszky (1926: 1307)⁸⁵ considers it a form. The writer reserves any expression of opinion, and for the present paper has entered the entity as a distinct variety until a revision of the species brings to light the status of this form.

31. *Nitella minuta* Allen⁸⁰

Nitella minuta Allen, Char. Amer. Exsicc. 34. 1888.⁸⁷ (descr.)

LITERATURE FOR NORTH AMERICA:

Nitella minuta: Allen, Char. Amer. 1: 7, 39, 46 (key). 1888. — in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889. — Nordstedt, Lunds Univ. Årsskr.

25(4): 11. 1889. — Allen, Char. Amer. 2(3): 19 (key), 26 (descr.), pl. 25. 1896.

⁸³ Braun (1868: 882).

⁸⁴ Conspectus Systematicus Characearum Europaeorum, pp. 1–7. 1867.

⁸⁵ Folia Crypt. 10: 1307–1316. 1926.

⁸⁰ In connection with *N. minuta* Allen, the facts concerning *N. Maxceana* should be brought to attention. Allen (1896: 27) reported a divergent form of *N. minuta* which appeared to be sufficiently distinct to be considered a new species. He described this plant on the insufficient material available, suggested the name *N. Maxceana*, and cited the specimen as collected by "Dr. Morong, Nantucket, Mass." He emphasized, however, that the material available was not adequate to establish a new species, and stated that he withheld his opinion until new material was obtained. The information concerning this species is reassembled here: ***Nitella Maxceana*** Allen, spec. dub., Char. Amer. 2(3): 27, footnote. 1896. Plant similar to *N. minuta* except for the larger, partially inflated stem, 220 μ in diameter; and the smaller, solitary oogonia, 156 μ long by 136 μ wide. ILLUSTRATIONS: None. EXSICCATAE: (Non vidi). DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Nantucket, Allen (1896: 27) (TYPE LOCALITY).

⁸⁷ cf. Wood, Farlowia 3: 328. 1948, for proposed dates for Allen's exsiccatae.

Plant monoecious, 2–6 cm. high. **Branchlets** (number not stated). **Sterile branchlets** filiform and spreading, undivided. **Fertile branchlets** twice divided. **Dactyls of fertile branchlets** 3, 2-celled, the apical cell a mucro about $120\ \mu$ long by $30\ \mu$ in diameter at the base. **Game-tangia** solitary, fertile portions enveloped in mucus. **Oogonia** solitary (dimensions not stated). **Oospores** $350\ \mu$ long by $285\ \mu$ wide; **striations** of 6 thick and prominent ridges; **membrane** marked by roundish elevations or granules. **Antheridia** $200\ \mu$ in diameter.⁸⁸

ILLUSTRATIONS: Allen (1896: pl. 25), Nordstedt (1889: pl. 1, fig. 11, for oospore membrane).

EXSICCATAE: Char. Amer. Exsicc. 34. 1888.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Allen (1896: 27) as a questionable record; — New Jersey, Allen (1888: No. 34, exsicc.) for Green Pond (TYPE LOCALITY).

The first description of this plant appeared on the label of the exsiccata specimen No. 34. This specimen bears the data: "Habitat: Green Pond, New Jersey, Coll.: T. F. Allen, September, 1883." The plant was described in print later by Allen (1896: 26), wherein he omitted the earlier discussion concerning the antheridia, but added the information on the oospore membrane.

The species was confirmed by Nordstedt (1889: 11; 1918:⁸⁹ pl. 3).

32. *Nitella Nordstedtiana* Groves, H. & J.

(Non) *Chara batrachosperma* Thuillier, Fl. Envir. Paris, ed. 2, p. 473. 1799. (= *C. vulgaris* Linn. = *C. foetida* Braun (1847: 10)).

Chara batrachosperma Thuillier, accord. to Reichenbach, Iconogr. Bot. 8: 794. 1830. — Fl. Germ. Excursoria 1: 148. 1832.

(Non) *Nitella batrachosperma* (Thuillier) Agardh, Syst. Alg. p. 126. 1824. (= *C. vulgaris* Linn., pro synon.).

Nitella batrachosperma (Reich.) Braun, Neue Denkschr. schweiz. Gesell. Naturw. 10(3): 10. 1847.

Nitella Nordstedtiana Groves, H. & J., Journ. Bot. 28: 67. 1890.

Nitella batrachosperma Braun; Groves and Bullock-Webster, Brit. Char. 1: 124. 1920.

LITERATURE FOR NORTH AMERICA:

Nitella batrachosperma: Kützinger, Spec. Alg. p. 515. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 256. 1854. — Allen, Bull. Torrey Bot. Club 2(3): 10. 1871. — Char. Amer. 2: 13. 1880. — Char. Amer. 1: 46 (key). 1888. — Owen, Pl. Nantucket, p. 74. 1888. — Nordstedt, Lunds Univ. Årsskr. 25(4): 10. 1889. — Allen, Char. Amer. 2(3): 27. 1896. — Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (= *N. tenuissima* fide Wood⁹⁰). — Lilley, Minn. Bot. St. 3: 79–82, pl. 18. 1903. — Bach, Mich. Acad. Sci., Ann. Rep. 9: 126. 1907. — Daily, Butler Univ. Bot. St. 6: 154. 1944.

Plant monoecious, extremely small and delicate, up to about 5 cm. high. Internodes 1–4 times the length of the branchlets. **Sterile and fertile branchlets** 8 in a whorl; 2 (–3) times divided; secondary rays 4–6.

⁸⁸ Allen, Characeae Americanae Exsicc., 34, supplemented from Allen (1896: 26).

⁸⁹ Australian Characeae 1. Proc. Roy. Soc. Victoria, N. S. 31: 1–4, pl. 1–10. 1918.

⁹⁰ Wood, Ohio Journ. Sci. 47: 247. 1947.

Dactyls 3–7, uniformly 2-celled, frequently more than half the length of the entire branchlet. **Gametangia** at the first and occasionally at the second branchlet node, solitary; sometimes enveloped in mucus. **Oogonia** solitary, about 375–450 μ long by 300–350 μ wide; enveloping cells showing 8–9 convolutions: **coronula** minute, 15–25 μ high, persistent. **Oospores** dull yellow-brown, 225–300 μ long, 200–250 μ broad, 175 μ thick; **striations** of 6–8 broad, flanged ridges; **membrane** thin, flexible, and translucent, dull yellow-brown, finely granular at first and later tending to become thick and definitely reticulate. **Antheridia** 175–200 μ in diameter.⁹¹

ILLUSTRATIONS: Migula (1897: fig. 52), Groves & Bullock-Webster (1920: pl. 15).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXXVII, 1849; Tilden, Amer. Algae, 530.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Allen (1871: 10), Owen (1888: 74); — Michigan, Bach (1907: 126); — Minnesota, Lilley (1903: 79); — Nebraska, Daily (1944: 154).

TYPE LOCALITY: Europe.

The name *Chara batrachosperma* was first validly published by Thuillier (1799: 473). Subsequently, Braun (1847: 10) showed this plant to be identical to *C. foetida* Braun (= *C. vulgaris* Linn.). Agardh (1824: 126) transferred Thuillier's plant to the genus *Nitella*, giving the combination *Nitella batrachosperma* (Thuill.) Ag. (= *C. vulgaris* Linn.). Reichenbach (1830: 794) published the record of a plant determined as *C. batrachosperma* Thuill., which Braun (1847: 10) recognized as a new species, and transferred it to the genus *Nitella* as *N. batrachosperma* (Reich.) Braun, *pro synon.* Kützing (1849: 515) published the first description of Reichenbach's plant. Groves, H. & J. (1890: 67) apparently recognized that both *C. batrachosperma* Reich. and *N. batrachosperma* (Reich.) Braun were preoccupied by Thuillier's and Agardh's names, and redescribed the plant under the name *N. Nordstedtiana* Groves, H. & J. The assigning of the new name is now obligatory under Art. 69 of the "International Rules of Botanical Nomenclature" (1935). Recent students have consistently retained Braun's name, apparently in disregard of the later homonym rule.

33. *Nitella pygmaea* Braun

Nitella pygmaea Braun, Abh. k. Akad. Wiss. Berlin (1882): 65. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella pygmaea: Braun, l.c. — Allen, Char. Amer. 1: 46 (key). 1888. — Nordstedt, Lunds Univ. Årsskr. 25(4): 10. 1889. — Allen, Char. Amer. 2(3): 26, pl. 24. 1896.

Plant monoecious, 2.5–5 cm. high, compact. **Sterile branchlets** 6 in a whorl, twice divided into 3–5 secondary rays (of which one is occasionally simple) and 3–4 tertiary rays (dactyls). **Dactyls of sterile branchlets** 2-celled, including the mucro; penultimate cell and mucro tapering toward apex. **Fertile branchlets** 6, 2–3 times divided, with 2–3

⁹¹ Groves & Bullock-Webster (1920: 124), supplemented from Zaneveld (1940: 80).

terminal dactyls. **Dactyls of fertile branchlets** same as for the sterile. **Gametangia** at the first branchlet node, aggregated, mucus (?). **Oogonia** 2 (-3). **Oospores** yellow-brown, 250 μ long, 210 μ wide; **striations** of 7 faint ridges; **membrane** finely reticulate,⁹² the reticulae about 3-6 μ in diameter. **Antheridia** 240-250 μ in diameter.⁹³

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 47-49), Allen (1896: pl. 24 — after Braun).

EXSICCATAE: None issued. Specimen: *Liebmann*. Jan. 1843. In paludosis prope Mirador, Mexico (NY), Flora Mexicana.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Mirador (TYPE LOCALITY), Braun (1883: 65).

This species was differentiated by Braun from *N. tenuissima* primarily on the occurrence of the sex organs at the first instead of the second branchlet furcation, and from *N. batrachosperma* (= *N. Nordstedtiana* Groves, of the present paper) by the faint ridges of the oospore. The species was described on the specimen cited as "Mexic. Liebmann. NORD-AMERIKA. In paludosis prope Mirador (Fl. Mexic.) Jan. 1843." Nordstedt (1889: 10) added information on the oospore membrane, and concurred with the distinct species.

34. *Nitella Asagrayana* Schaffner ex Nordstedt apud Braun

Nitella Asagrayana Schaffner (in litt.⁹⁴) ex Nordstedt apud Braun, Abh. k. Akad. Wiss. Berlin (1882): 67. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella Asagrayana: Nordstedt in Braun, l.c.: 67. — Nordstedt, Lunds Univ. Arsskr. 25(4): 11. 1889. — Allen, Char. Amer. 1: 46 (key). 1888.

Nitella Asagraeana:⁹⁵ Allen, Char. Amer. 2(3): 19 (key), 28 (descr.), pl. 27. 1896.

Plant monoecious (?), 15-20 cm. high, branched. **Sterile branchlets** 6, spreading, 20-30 mm. long, 2 times divided into 4 secondary rays (-5 mm. long), and 3 tertiary rays (dactyls). **Dactyls of sterile branchlets** about 0.5 mm. long, 2-celled, including the sharp terminal mucro (very evanescent, rarely present on old specimens). **Fertile branchlets** 5 (-6) in a whorl, once or twice divided, condensed into spike-like heads

⁹² Nordstedt (1889: 10).

⁹³ Braun (1883: 65).

⁹⁴ Nordstedt's original description cites "*Nitella Asagrayana* Schaffner in litt. sec. Farlow in sedul." Dr. R. M. Wheldon has graciously investigated the records of the Farlow Reference Library and Herbarium pertaining to this specimen, and has assembled the following facts. Schaffner's letter of about 1878 to Nordstedt (or Braun), in which he apparently described his new species and gave the name, was not located. Dr. Farlow, about 1879, wrote to Nordstedt (or Braun), probably giving the substance of Schaffner's description and adding his own criticisms (probably lost). Nordstedt's letter of April, 1880, to Dr. Farlow agreed with Dr. Farlow that Schaffner's plant was only a variety of *N. gracilis*. This letter is extant in the Farlow files. Nevertheless, Nordstedt published a description of this plant in Braun (1883: 67), and accredited Schaffner for the species.

⁹⁵ As stated by Allen (1896: 28), Schaffner's original spelling of this species, as it appeared on the specimen, was *Asagraeana*. However, the original description and subsequent works by Nordstedt used *Asagrayana*, so that there is no doubt concerning the intended spelling for the species.

5–6 mm. in diameter,⁹⁶ densely enveloped in mucus. **Dactyls of fertile branchlets** 2–3, 2-celled, including a sharp mucro. **Gametangia** isolated at nodes of branchlets. **Oogonia** solitary. **Oospores** 272–290 μ long, 175–190 (–230) μ broad;⁹⁷ **striations** of 5–6 sharp, prominent ridges; **membrane** grumous. **Antheridia** about 170 μ in diameter.⁹⁸

ILLUSTRATIONS: Allen (1896: pl. 27).

EXSICCATAE: None issued. Specimen: *J. G. Schaffner*, 1876. In stagnant pools about Morales, near San Luis Potosi, Mexico (FH), 6, *Flora Mexicana*.⁹⁹

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — San Luis Potosi, Nordstedt in Braun (1883: 67), Allen (1896: 28) for Morales (TYPE LOCALITY).

Nordstedt's description of this species, which was inserted into Braun's (1883: 67) "Fragmente," was based on the specimen cited by Allen (1896: 28) as "Dr. J. G. Schaffner, 1876. In stagnant pools about Morales, near San Luis Potosi, Mexico [FH] — No. 6, *Flora Mexicana* (Exsiccatae?)."

35. *Nitella intermedia* Nordstedt apud Allen

Nitella intermedia Nordstedt apud Allen, Char. Amer. Exsicc. 2. 1880. (descr.). — Nordstedt, Lunds Univ. Årsskr. 25(6): 25. 1889.

LITERATURE FOR NORTH AMERICA:

Nitella intermedia: Nordstedt in Braun, Abh. k. Akad. Wiss. Berlin (1882): 67. 1883. (nom. nud.). — Allen, Char. Amer. 1: 6, 28 (fig. 35), 46 (key). 1888. — in Bennett, Pl. Rhode Island, p. 58. 1888. — Nordstedt, Lunds Univ. Årsskr. 25(6): 25. 1889. — Allen in Britton, Final Rep. State Geol. (N. Jersey) 2: 356. 1889. — Char. Amer. 2(3): 19 (key), 27 (descr.), pl. 26. 1896. — Burnham & Latham, Torreya 23: 4. 1923. — Grier, Amer. Midl. Nat. 9: 60. 1924–5.

Plant monoecious. **Branchlets** 6–8 in a whorl, 2–3 times divided. **Dactyls** 3, 2 (–3)-celled; apical cell an elongated mucro. **Gametangia** in all divisions of the branchlets, solitary. **Oogonia** (dimensions not given). **Oospores** about 360 μ long; **striations** of 8 slightly prominent ridges; **membrane** densely granular-punctate. **Antheridia** 240 μ in diameter.¹⁰⁰

ILLUSTRATIONS: Allen (1896: pl. 26).

EXSICCATAE: Allen, Char. Amer. Exsicc. 2; Phyc. Boreali-Amer., Fasc. XXXVII, 1841.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — New Jersey, Nordstedt in Allen (Char. Amer. Exsicc. 2) for "Morris Pond" (TYPE LOCALITY), Allen in Britton (1889: 356); — New York, Burnham & Latham (1923: 4), Grier (1924–5: 60); — Rhode Island, Allen in Bennett (1888: 58).

This plant was first described (presumably) by Nordstedt in a diagnosis printed on the label of the specimen in Allen's Characeae Americanae

⁹⁶ Nordstedt in Braun (1883: 67).

⁹⁷ Oospore 300–320 μ long, 270–300 μ broad, according to Nordstedt in Braun (1883: 67).

⁹⁸ Allen (1896: 28).

⁹⁹ According to Allen (1896: 28).

¹⁰⁰ Nordstedt (1889: 25).

Exsicc., No. 2, as "*Nitella intermedia* Nordst. Nov. spec.," bearing the collecting data: "Habitat: 'Morris pond,' New Jersey. Coll.: T. F. Allen, M. D. August, 1880." As the first two fascicles of this exsiccatae set were issued in 1880, this is the date of publication of the description. The diagnosis on the label renders the rank for the new name rather ambiguous, by stating "Eunitella, diarthrodactyla, homoeophylla, monoica, gloeocarpa. Subspecies *N. mucronata*, A. Br. sensu latiore." This would suggest that Nordstedt meant the new name to be interpreted as *Nitella mucronata* subspecies *intermedia*. However, as *N. mucronata* Braun sensu latiore was treated as a subgeneric section of *Nitella* by Nordstedt in Braun (1883: 11) (= "Mucronatae" Allen (1880: 106)), and as both Allen and Nordstedt employed the full specific status of *N. intermedia* Nordst. in subsequent publications, it is concluded that such was intended in the original diagnosis. Nordstedt (1889: 25) redescribed the plant, using the name *N. intermedia* Nordst.

The writer has found no further monographic confirmation of this species in the literature. The records that appear are confined to floristic lists, based on determinations by Allen.

36. *Nitella gracilis* (Smith) Agardh

Chara gracilis Smith, Eng. Bot. **30**: pi. 2140. 1810.

Nitella gracilis Agardh, Syst. Alg. p. 125. 1824.

LITERATURE FOR NORTH AMERICA:

Nitella gracilis: Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 358. 1859. — Allen, Bull. Torrey Bot. Club **2**(3): 10. 1871. — Halsted, Proc. Boston Soc. Nat. Hist. **20**: 176. 1879. (pro parte, cf. *N. mucronata* var. *tenuior*, accord. to Allen). — Robinson, Fl. Essex Co., Mass. p. 146. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 58. 1883. — Allen in Bennett, Pl. Rhode Island, p. 58. 1888. — Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888. — Allen, Char. Amer. **1**: 46 (key). 1888. — in Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889. — Bull. Torrey Bot. Club **21**: 524. 1894. — Char. Amer. **2**(3): 19 (key), 20, 22, 23 (descr.), pl. 21. 1896. — Bull. Torrey Bot. Club **25**: 75. 1898. — Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (a doubtful record).

Plant monoecious, very slender. Internodes 1–2 times as long as the branchlets. **Branchlets** 5–6 in a whorl, slender, 2–3 times divided; primary rays equal to about half the total length of the branchlet. **Dactyls** 3–4, of which 1–2 are again forked; 2–3-celled; the penultimate cell tapering somewhat toward the apex; apical cell a narrowly-conical, acute mucro. **Gametangia** frequently occurring at all divisions of the branchlets, not enveloped in mucus. **Oogonia** solitary, about 525 μ long by 350 μ wide; **coronula** persistent, 25–30 μ high. **Oospores** broadly ellipsoidal, 250–300 μ long, 225–250 μ wide, 175–200 μ thick, light brown; **striations** of about 6 rather prominent ridges; **membrane** thin and flexible, bright yellow-brown, very finely granulate. **Antheridia** about 300 μ in diameter.¹⁰¹

¹⁰¹ Groves & Bullock-Webster (1920: 118).

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 13), Allen (1896: pl. 21), Migula (1897: 168).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXIV, 1195.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Halsted (1879: 177), Robinson (1880: 146), Dame & Collins (1888: 151); — New Hampshire, Allen (1896: 23); — New Jersey, Allen *in* Britton (1889: 356); — New Mexico, Halsted (1879: 177); — Rhode Island, Allen *in* Bennett (1888: 58); — Texas, Braun (1883: 58); — Vermont, Halsted (1879: 177), Allen (1896: 23); **Canada**: — Quebec, Braun (1883: 58), Allen (1896: 23).

TYPE LOCALITY: Europe.

The first appearance of the name *Chara gracilis* in the literature was the description by Smith (1810: pl. 2140) based on the specimen cited as “. . . gathered Sept. 4, 1809, in a boggy pool in St. Leonard's forest, Sussex (England), by Mr. W. Borrer.” Agardh (1824: 125) transferred the plant to the genus *Nitella*.

Nitella gracilis forma **divaricata** Migula

Nitella gracilis forma *divaricata* Migula *in* Rabenhorst, Krypt. — Fl. Deutschl. ed. 2: 5: 170. 1897.

LITERATURE FOR NORTH AMERICA:

Nitella gracilis forma *divaricata*: Allen, Char. Amer. 2(3): 23. 1896.

This form is characterized by the elongated stem, 415 μ in diameter, unbranched, and bearing remote whorls of leaves. Branchlets 6 in a whorl; primary ray half the length of the entire branchlet; secondary rays 6; tertiary rays 4–5; quaternary rays 4 [2–3?]. Dactyls 2–3, quite long, and usually 3-celled, sometimes again furcate; terminal cell a mucro about 25 μ in diameter and 60–65 μ long. Gametangia isolated at second and third nodes of the branchlets. Oogonia isolated. Oospores 260 μ long, 220 μ wide, striations (number not given) prominent; membrane (data not given). Antheridia (data not given).¹⁰²

ILLUSTRATIONS: Migula (1897: 168).

EXSICCATAE: None. Specimen: *Josiah Hale*, Louisiana, as *Chara foliosa* (NY) (FH) (MO).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Allen (1896: 23).

TYPE LOCALITY: Europe.

This form was described by Migula (1897: 170) based on the specimen cited as “Bei Löwenberg in Schlesien 1865 von Cantor Dressler gesammelt.”

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¹⁰² Allen (1896: 23).

EXSICCATAE CITED

- Allen, T. F.** 1880-1893.¹⁰³ *Characeae Americanae Exsiccatae*, Fasc. I-V.
 ———. 1895-1898.¹⁰³ *Characeae Japonicae Exsiccatae*, Fasc. I, II.
Braun, A., L. Rabenhorst and E. Stizenberger. 1857-1878. *Die Characeen Europas* (Exsicc.), Fasc. I-V.
Collins, F. S., I. Holden and W. A. Setchell. 1895-1919. *Phycotheca Boreali-Americana*, Fasc. I-XLV, A-E.
Nordstedt, C. F. O., and L. J. Wahlstedt. 1871-1874. *Characeae Scandinaviae Exsiccata*, Fasc. I-III.
Tilden, Josephine E. 1894-1909. *American Algae*, Fasc. I, Cent. 1-7.

LITERATURE CITED

- Agardh, C. A.** 1824. *Systema Algarum I.* Lund.
 ———. 1825. Observations sur le genre Chara. *Ann. Sci. Nat.* 4: 61-66.
 ———. 1826. Ueber die Anatomie und den Kreislauf der Charen. *Nov. Act. Acad. Leop. Carol.* 13: 113-162.
Allen, G. O. 1940. IX. Charophyta, in *The Percy Sladen Trust Expedition to Lake Titicaca in 1937*. *Trans. Linn. Soc. London* 1³: 155-160.
Allen, G. O. and W. G. Herter. 1934. Charales Uruguayensis. *Revista Sudamericana de Bot.* 1: 87-91.
Allen, T. F. 1871. *Characeae*. *Bull. Torrey Bot. Club* 2(3): 9-10.
 ———. 1879. *Characeae Americanae* 1: pl. 1. 2: pl. 2. New York.
 ———. 1880. *The Characeae of America* 1: 1-8, pl. 1-3. 2: 9-14, pl. 4-6. Boston. (Certain pages bear the title "Characeae Americanae.")
 ———. 1880. Similarity between the Characeae of America and Asia. *Bull. Torrey Bot. Club* 7: 105-107.
 ———. 1882. Development of the cortex in Chara. *Ibid.* 9: 37-47, pl. 15-22.
 ———. 1883. [Notes on the Characeae of Lawlor's Lake] (Lacustrine formation of Torryburn Valley). *Bull. Nat. Hist. Soc. New Brunswick* 1³: 9-15.
 ———. 1883. Notes on the American species of Tolypella. *Bull. Torrey Bot. Club* 10: 109-117, pl. 37-42.
 ———. 1887. Some notes on Characeae. *Ibid.* 14: 211-215, pl. 71-75.
 ———. 1888. *The Characeae of America* 1: 1-64, fig. 1-54. New York.
 ———. 1888. Nitella (not Tolypella) Macounii. *Bull. Torrey Bot. Club* 15: 11.
 ———. 1889. *Characeae*, in N. L. Britton, *Catalogue of plants found in New Jersey*. *Final Rep. State Geologist (N. Jersey)* 2: 356, 357.
 ———. 1892. *The Characeae of America* 2(1): 1-8, pl. 1-8. New York. [For the basis used in numbering these plates, see under "Notes."]
 ———. 1892. Notes on some Characeae. *Bull. Torrey Bot. Club* 19: 230.
 ———. 1892. In R. S. Williams, *The flora of a Montana pool*. *Ibid.* 19: 192-194.
 ———. 1893. Notes on new Characeae. *Ibid.* 20: 119-120.
 ———. 1893. Notes on some Characeae. *Ibid.* 20: 258.
 ———. 1894. *The Characeae of America* 2(2): 9-17, pl. 9-17. New York.
 ———. 1894. Remarks on Chara gymnopus A. Br. with descriptions of new species of Chara and Nitella. *Bull. Torrey Bot. Club* 21: 162-167, pl. 185-192.
 ———. 1894. Japanese Characeae. *Bull. Torrey Bot. Club* 21: 523-536.
 ———. 1895. Japanese Characeae II. *Ibid.* 22: 68-71.
 ———. 1896. *The Characeae of America* 2(3): 19-28, pl. 18-27. New York.
 ———. 1896. Nitella subspicata sp. nov. *Bull. Torrey Bot. Club* 23: 6-7, pl. 253.
 ———. 1896. A new species of Nitella, belonging to the Nitella flexilis series, with a review of the allied species. *Ibid.* 23: 533, pl. 285, 286.
 ———. 1896. New species of Nitella belonging to the monoecious acuminatae group, with a review of the allied species. *Ibid.* 23: 534-536, pl. 285, 286.
 ———. 1898. Contributions to Japanese Characeae III. *Ibid.* 25: 73-82.

¹⁰³ See Wood, *Farlowia* 3: 327-329. 1948, for proposed dates for Allen's exsiccatae.

- . 1901. Characeae, in C. Mohr, Plant life of Alabama. Contrib. U. S. Nat. Herb. 6: 1-921. [p. 147]. (Reprinted in Geol. Survey of Alabama.)
- Amici, G. B.** 1827. Descrizione di alcune specie nuove di Chara. (Reprinted in Mem. Accad. Sci. Modena 1: 199-221, pl. 1-5. 1833.)
- Bach, Ellen B.** 1907. The Characeae of Michigan. Mich. Acad. Sci., Ann. Rep. 9: 126.
- Barton, W. P. C.** 1818. Compendium Florae Philadelphicae 2. Philadelphia.
- Bennett, J. L.** 1888. Plants of Rhode Island. Providence.
- Bigelow, J.** 1824. Florula Bostoniensis, ed. 2. Boston.
- Bischoff, G. W.** 1828. Die kryptogamischen Gewächse, mit besonderer Berücksichtigung der Flora Deutschlands und der Schweiz. Nürnberg.
- Braun, A.** 1834. Esquisse monographique de genre Chara. Ann. Sci. Nat. 1²: 349-357.
- . 1835. Uebersicht der genauer bekannten Chara-Arten. Flora 18: 49-73.
- . 1843. Charae Preissianae adiectis reliquis speciebus e nova hollandia hucusque cognit. Linnaea 17: 113-119.
- . 1844. [A brief notice of the Charae of North America]. Amer. Journ. Sci. and Arts 46: 92, 93.
- . 1845. [Additional notices of the North American Charae], in G. Engelmann and A. Gray. Plantae Lindheimerianae. Boston Journ. Nat. Hist. 5: 264.
- . 1847. Uebersicht der schweizerischen Characeen. Neue Denkschr. schweiz. Gesell. Naturw. 10(3): 1-23. [For date: First noticed in Bot. Zeit. 7: 872. 1849. However, this particular paper was received by Regensb. bot. Gesell. in January 1848, and said to have been issued in 1847 (cf. No. 12 in list of accessions for 1848, Flora 31: 88). Signature date in original publication is given as "Juni 1847."]
- . 1849. Charae australes et antarcticae. Hooker's Journ. Bot. and Kew Gard. Misc. 1: 193-203.
- . 1849. Characeae Indiae orientalis et insularum maris pacificis. Ibid. 1: 292-301.
- . 1859. Characeen aus Columbien, Guyana und Mittelamerika. Monatsber. k. Akad. Wiss. Berlin (1858): 349-367.
- . 1860. Characeae, in J. D. Hooker, Flora Tasmaniae 2. London.
- . 1866. Characeen, in G. von Martens. Die preussische Expedition nach Ost-Asien., Bot. Theil. "Die Tange." p. 143. Berlin.
- . 1867. Conspectus Systematicus Characearum Europaeorum. Dresden.
- . 1867. Characeae, in J. D. Hooker. Handbook of the New Zealand Flora. London.
- . 1868. Die Characeen Afrika's. Monatsber. k. Akad. Wiss. Berlin (1867): 782-801, 873-944.
- (Reprinted and repaged consecutively from 782-872. This pagination was followed in references cited in Braun's "Fragmente" (1883).)
- . 1876. Characeen (Armleuchter-Gewächse), in F. Cohn. Kryptogamen-Flora Schlesien, 1. Breslau.
- . 1883. Fragmente einer Monographie der Characeen. Nach der hinterlassenen Manuscripten A. Braun's herausgegeben von Dr. O. Nordstedt. Abh. k. Akad. Wiss. Berlin (1882): 1-211, pl. 1-7.
- (Nordstedt added certain portions to the original work. These were set off by brackets — cf. Nordstedt in Braun.)
- Brébisson, A.** 1859. Flore de la Normandie. ed. 3. Caen.
- Briquet, J. et al.** 1935. International Rules of Botanical Nomenclature. Jena. (cf. Camp, et al. 1947.)
- Britton, N. L.** 1884. On the composition and distribution of the flora of New Jersey. Bot. Gaz. 9: 156.
- Bruzellius, A.** 1824. Observationes in Genus Charae. (Dissert.). Lund.
- Burnham, S. H., and R. A. Latham.** 1923. The flora of the town of Southold, Long Island, and Gardiner's Island, New York. Torreyia 23: 3-9.
- Camp, W. H., H. W. Rickett and C. A. Weatherby.** 1947. International Rules of Botanical Nomenclature. Brittonia 6: 1-120.

- Candolle, de, A. B.** 1805. *In* J. B. Lamark. Flore Francaise 6: 246. [Certain editions were mistakenly dated 1815 on the front page (cf. Journ. Bot. p. 431. 1896).]
- Chevallier, F. F.** 1827. Flore Générale des Environs de Paris 2: 123-128. Paris.
- Clark, J.** 1852. Catalogue of flowering plants and ferns observed in the vicinity of Cincinnati. Cincinnati.
- Collins, F. S.** 1894. Algae, *in* E. L. Rand and J. H. Redfield. A Preliminary Flora of Mount Desert, Maine. Cambridge.
- Crépin, F.** 1863. Les Characées de Belgique. Bull. Soc. Roy. Bot. Belg. 2: 115-131. (Reprinted and repaged 1-21.)
- Daily, Fay Kenoyer.** 1944. Characeae of Nebraska. Butler Univ. Bot. St. 6: 149-171.
- . 1945. The Characeae of Indiana—A preliminary report. Butler Univ. Bot. St. 7: 124-131.
- Dame, L. L., and F. S. Collins.** 1888. Flora of Middlesex County, Massachusetts. Malden.
- Day, D. F.** 1883. The plants of Buffalo and its vicinity. Bull. Buffalo Soc. Nat. Hist. 4: 65-254.
- Desvaux, N. A.** 1809. Essai sur la Géographie-Botanique du Haut-Poitou (Département de la Vienne). Plantes trouvées dans le Haut-Poitou, les unes nouvelles, les autres, point indiquées dans la Flore de France. Journ. de Bot. 2: 290-318.
- . 1810. *In* Loiseleur-Deslongchamps. Notice sur les Plantes à ajouter à la Flore de France. pp. 135-138. Paris.
- . 1818. Observations sur les plantes des environs d'Angers. Paris.
- Eaton, A.** 1824. A Manual of Botany for the Northern States. ed. 4. Albany.
- Eaton, A. and J. Wright.** 1840. North American Botany. Troy.
- Eaton, D. C.** 1871. *In* Watson. Bull. U. S. Geol. Expl. Fortieth Parallel. 5: 398.
- Elliott, S.** 1824. Sketch of the Botany of South Carolina and Georgia 2. Charleston.
- Farlow, W. G.** 1883. Notes on the Cryptogamic flora of the White Mountains. Appalachia 3: 232-252.
- Frost, C. C.** 1875. Characeae, *in* E. Tuckermann and C. C. Frost. A Catalogue of Plants Growing Without Cultivation Within Thirty Miles of Amherst College. Amherst.
- Ganterer, U.** 1847. Die bisher bekannten österreichischen Charen. (Dissert.). Vienna.
- Gay, C.** 1854. Historia Física y Política de Chile: Botanica 6. Paris and Santiago.
- Grier, N. M.** 1924-5. The geology of Long Island with especial reference to the Cold Spring Harbor Region and its flora. Amer. Midl. Nat. 9: 1-265.
- Groves, H. and J.** 1880. A review of the British Characeae. Journ. Bot. 18: 97-103, 129-135, 161-167, pl. 207-210.
- . 1883. Notes on the British Characeae. Journ. Bot. 21: 20-23.
- . 1890. Notes on the British Characeae. Journ. Bot. 28: 65-69, pl. 296.
- . 1911. Characeae, *in* Ignaz Urban, Symbolae Antillanae, seu Fundamenta Florae Indiae Occidentalis 7(1): 30-44. Berolini.
- Groves, J.** 1935. The primary divisions of the genus Nitella. Journ. Bot. 73: 46-49.
- Groves, J. and G. R. Bullock-Webster.** 1920. British Charophyta 1. London.
- . 1924. Ibid. 2. London.
- Halsted, B. D.** 1879. Classification and description of the American species of Characeae. Proc. Boston Soc. Nat. Hist. 20: 169-190.
- Hartman, C. J.** 1846. Handbok i Skandinavien Flora, ed. 5. Stockholm.
- Harvey, F. L.** 1895. Contribution to the Characeous Plants of Maine 1. Bull. Torrey Bot. Club 22: 397-398.
- Hornemann, J. W.** 1819-1840. *In* Flora Danica, pl. 1656, 1940, 1941, 2311. Copenhagen.
- James, J. F.** 1879. Catalogue of the flowering plants, ferns and fungi growing in the vicinity of Cincinnati. Journ. Cincinnati Soc. Nat. Hist. 2: 42-68.
- Krocker, A. J.** 1814. Florae Silesiacae 3. Breslau.
- (Other volumes were titled "Flora Silesica.")

- Kützing, F. T.** 1843. *Phycologia Generalis oder Anatomie, Physiologie und Systemkunde der Tange*. Leipzig.
- . 1845. *Phycologia Germanica*. Nordhausen.
- . 1849. *Species Algarum*. Leipzig.
- . 1857. *Tabulae Phycologicae, oder Abbildungen der Tange* 7. Nordhausen.
- Leiberg, J.** 1886. Notes on some of the rare plants found in the Blue Earth and Pipestone counties, Minnesota, during the summer of 1882. *Bull. Minn. Acad. Nat. Sci.* 3: 37-38.
- Leonhardi, von, H.** 1863. Die böhmischen Characeen. *Lotos* 13: 55-80, 110-111.
- . 1863. Weitere Characeen-Fundorte. *Lotos* 13: 129-132.
- . 1864. Die bisher bekannten österreichischen Armleuchter-Gewächse. *Verhandl. naturf. Vereins Brünn* 2: 122-224.
(Reprinted and repaged 1-106.)
- Lilley, G.** 1903. *Nitella batrachosperma* in Minnesota. *Minnesota Bot. St.* 3: 79-82, pl. 18.
- Lillick, L. C.** 1937. Freshwater algae from Texas. *Pap. Michigan Acad. Sci. Arts & Lett.* 22: 142-152, pl. 17, 18.
- Linnaeus, C.** 1753. *Species Plantarum* 2: 1157.
- Migula, W.** 1890-1897. Die Characeen Deutschlands, Oesterreichs und der Schweiz, *in* L. Rabenhorst. *Krypt.-Fl. Deutschl. Oesterr. und der Schweiz*, ed. 2. 5.
- Miquel, F. A. G.** 1840. *Algae*, *in* H. C. van Hall. *Flora Belgii Septentrionalis* 2. Amsterdam.
- Nees von Esenbeck, C. G.** 1818. *Chara capitata*, eine neue Art von Armleuchter nebst Bemerkungen über die Fruchttheile der Gattung. *Denkschr. k. beierisch. bot. Gesell.* 2: 64-83.
- Nordstedt, C. F. O.** 1880. De Algis et Characeis 2. *Lunds Univ. Årsskr.* 16: 15-20.
- . 1883. *In* A. Braun. *Fragmente einer Monographie der Characeen*. Nach der hinterlassenen Manuscripten A. Braun's herausgegeben von Dr. O. Nordstedt. *Abh. k. Akad. Wiss. Berlin* (1882): 1-211, pl. 1-7.
- (As stated in the introduction to this work, Nordstedt retained Braun's original manuscripts without alteration. Additions made by Nordstedt were set off by brackets. These included several new species and subspecific forms. The "Clavis synoptica Characearum" was also written by Nordstedt. The inconsistencies in nomenclature which exist between portions written by the two authors have apparently been interpreted by certain workers as inconsistencies in Braun's treatment. Upon this basis such workers have found grounds for changes in orthography of names. Such conclusions are untenable.)
- . 1889. De Algis et Characeis 4-6. *Lunds Univ. Årsskr.* 25: 2-41, pl. 1.
- . 1889 *Characeae*, *in* E. von Askenasy, *Algen*, *in* Die Forschungsreise S. M. S. "Gazelle," IV. Theil. Berlin.
(*Characeae*, p. 4-8.)
- . 1918. Australasian *Characeae* 1. *Proc. Roy. Soc. Victoria N. S.*, 31: 1-4, pl. 1-10.
- Northrop, J. I. and Alice B. Northrop.** 1890. Plant notes from Tadousac and Temiscouata County, Canada. *Bull. Torrey Bot. Club* 17: 27-32.
- Nuttall, T.** 1818. The Genera of North American Plants 2. Philadelphia.
- Owen, Maria L.** 1888. A Catalogue of Plants Growing Without Cultivation in the Country of Nantucket, Mass. Northampton.
- Palmer, C. M.** 1929. *Algae of Indiana*—A classified check list of those published between 1875 and 1928. *Proc. Ind. Acad. Sci.* 38: 109-121.
- Peck, C. H.** 1869. *Characeae*. *Ann. Rep. State Cab., N. Y.* 22: 55.
- . 1874. *Characeae*. *Ann. Rep. N. Y. State Mus. Nat. Hist.* 26: 48.
- . 1883. *Characeae*. *Ibid.* 33: 36.
- . 1885. *Characeae*. *Ibid.* 38: 83-84.
- Persoon, C. H.** 1807. *Synopsis Plantarum* 2. Paris.
- Petkoff, S.** 1914. Les Characées de Bulgarie. *Nuova Notarisia* 25: 35-56. (Reprinted and repaged 3-24.)

- Pieters, A. J.** 1901. The plants of western Lake Erie. *Bull. U. S. Fish Comm.* (1901): 57-79, pl. 11-20.
- Pound, R. and F. E. Clements.** 1898. *The Phytogeography of Nebraska*, ed. 2 (1900). Lincoln.
- Prescott, G. W.** 1931. Iowa Algae. *Univ. Iowa Studies Nat. Hist.* 13: 1-235.
- Pursch, F.** 1814. *Flora Americae Septentrionalis*. London.
- Rabenhorst, L.** 1863. *Kryptogamen-Flora von Sachsen* 1. Leipzig.
- Ravenel, H. W.** 1876. *Nitella praelonga*, A. Br. *Bull. Torrey Bot. Club* 6: 82.
- Reichenbach, H. G. L.** 1830. *Iconographia Botanica* 8. Leipzig.
- . 1832. *Flora Germanica Excursoria* 1 and 2. Leipzig.
- Richard, L. C. M.** 1815. *In A. Humboldt and A. J. A. Bonpland. Nova Genera et Species Plantarum*. Paris.
- Riddell, J. L.** 1835. *A Synopsis of the Flora of the Western States*. Cincinnati.
- Robinson, C. B.** 1906. The Chareae of North America. *Bull. N. Y. Bot. Gard.* 4: 244-308.
- Robinson, J.** 1880. *The Flora of Essex County, Massachusetts*. Salem.
- Ruprecht, F. J.** 1845. *Distributio Cryptogamarum vascularium in Imperio Rossico*. Beiträge zur Pflanzenkunde des russischen Reiches 3: 7-18. Petrograd.
- . 1846. *Symbolae ad historiam et geographium plantarum Rossicarum*. Petrograd.
- Sawyer, Lucille.** 1926. *Charophyta of the Lake Okoboji Region*. M. S. Thesis. State Univ. Iowa.
- Smith, B. H.** 1932. The Algae of Indiana. *Proc. Ind. Acad. Sci.* 41: 177-206.
- Smith, J. E.** 1796-1810. *English Botany*. (Illustrated by J. Sowerby.) pl. 336, 463, 1070, 1703, 1855, 2140. London.
- Smith, J. G. and R. Pound.** 1893. *Flora of the Sand Hill Region of Sheridan and Cherry Counties*. Bot. Survey Nebraska 2: 1-30. Lincoln.
- Smyth, B. B.** 1893. Additions to the flora of Kansas. *Trans. Kansas Acad. Sci.* 13: 96-103.
- Stewart, Laurie M.** 1937. Studies in the life history of *Nitella hyalina* Agardh. *Journ. Elisha Mitchell Sci. Soc.* 53: 173-190, pl. 16-19.
- Taylor, W. R.** 1921. Additions to the flora of Mount Desert, Maine. *Rhodora* 23: 65-68.
- Thuellier, J. L.** 1799. *La Flore des Environs de Paris*, ed. 2. Paris.
- Wallman, J.** 1854. Försök till en systematisk uppställning af växtfamiljen Characeae. *K. Vets.-Akad. Handl.* (1852): 229-331.
- (French translation by **W. Nylander**. *Essai d'une exposition systematique de la famille des Characées*. *Act. Soc. Linn. de Bordeaux* 21³: 1-90. 1856.)
- Wallroth, C. F. W.** 1815. *Annus Botanicus*. Halle.
- Ward, L. F.** 1881. Guide to the flora of Washington and vicinity. *Bull. U. S. Nat. Mus.* 22.
- Webber, H. J.** 1889. The freshwater algae of the plains. *Amer. Nat.* 23: 1011-1013.
- . 1890. Catalogue of the flora of Nebraska. *Ann. Rep. Nebraska State Board Agric.* (1889): 175-302.
- . 1892. Appendix to the catalogue of the flora of Nebraska. *Trans. Acad. Sci. St. Louis* 6: 1-47.
- Willdenow, C. L.** 1805. Du genre nommé Chara. *Mém. Acad. Roy. Berlin* (1803): 79-90, pl. 1, 2.
- . 1806. Ueber die Gattung Chara. *Samml. deutsch. Abhandl. k. Akad. Wiss. Berlin* (1803): 54-62.
- . 1809. Fünf neue Pflanzen Deutschlands. *Gesell. nat. Freunde* 3: 298.
- Wood, A.** 1880. *A Class-Book of Botany*, ed. 2. New York.
- Wood, R. D.** 1947. The Characeae of the Put-in-Bay region, Lake Erie (Ohio). *Ohio Journ. Sci.* 47: 240-258, pl. 1-4.
- . On Rafinesque's names for the Characeae. *Bull. Torrey Bot. Club* 75(3): 282-285. 1948.

- . 1948. Proposed dates for T. F. Allen's *Exsiccatae* (Characeae). *Farlowia* **3**: 327-329.
- Woods, A. F.** 1894. Characeae, *in* *Flora of Nebraska* **2**: 122-128, pl. 25-36. Lincoln.
- Zaneveld, J. S.** 1940. The Charophyta of Malaysia and adjacent countries. *Blumea* **4**: 1-224, fig. 1-20.
- Zeller, G.** 1876. *Algae Brasiliensis*, *in* *Symbolae ad Floram Brasiliae Centralis Cognoscendam* **22**: 428.

EXPLANATION OF PLATE I

Range of variation in certain characters of *Nitella*

- Fig. 1-A — 1-F, Branchlets of a whorl:** 1-A, Homoeophyllous, branchlets simple, *N. californica*, sterile branchlets of a lower whorl, $\times 0.5$ (after Allen (1894: pl. 185)); 1-B, Homoeophyllous, branchlets once divided or furcate, *N. opaca*, $\times 0.8$ (after Allen (1892: pl. 1)); 1-C, Somewhat heterophyllous, some branchlets divided, others not divided, *N. occidentalis*, sterile whorls, $\times 0.6$ (after Allen (1894: pl. 187)); 1-D, Heterophyllous, *N. clavata*, sterile whorl, $\times ?$ (after Braun (1883: pl. 1)); 1-E, Homoeophyllous, branchlets 2-4 times furcate, *N. gracilis*, showing primary, secondary, tertiary, and quaternary rays, $\times 0.8$ (after Groves & Bullock-Webster (1920: pl. 13)); 1-F, Heterocleamous, branchlets forming two series, an outer whorl and a smaller inner whorl of accessory branchlets, *N. hyalina*, $\times 0.8$ (after Groves & Bullock-Webster (1920: pl. 16)).
- Fig. 2-A — 2-C, Heads of fertile whorls:** 2-A, Heads capitate, in axils of sterile whorls, *N. opaca*, $\times 0.8$ (after Groves & Bullock-Webster (1920: pl. 7)); 2-B, Heads terminal and axillary, *N. Morongii*, $\times 0.5$ (after Allen (1894: pl. 16)); 2-C, Heads terminal, enveloped in mucus, *N. praelonga*, $\times ?$ (after Allen (1894: pl. 11)).
- Fig. 3-A — 3-C, Oospore striae (striations):** 3-A, Oospore smooth, striae faint, *N. mucronata* subsp. *virgata* var. *leiopyrena*, $\times ?$ (after Braun (1883: pl. 1)); 3-B, Oospore striae thick, prominent ridges, *N. mucronata* subsp. *virgata* var. *pachygyra*, $\times ?$ (after Braun (1883: pl. 1)); 3-C, Oospore striae prominent and flanged, *N. flexilis*, $\times 23$ (after Groves & Bullock-Webster (1920: pl. 8)).
- Fig. 4-A — 4-B, Coronulae of oogonia:** 4-A, Upper tier of coronular cells greatly elongate, *N. dilitata*, $\times ?$ (after Allen (1894: pl. 13)); 4-B, Typical form, *N. tenuissima*, $\times 264$ (after Groves & Bullock-Webster (1920: pl. 14)).
- Fig. 5-A — 5-E, Location of gametangia:** 5-A, Antheridium terminal on primary ray in furcation of branchlets (dactyls), *N. opaca*, $\times 13$ (after Groves & Bullock-Webster (1920: pl. 7)); 5-B, Oogonia aggregate, 3 at a node, enveloped in mucus, plant dioecious (cf. 5-C), *N. capillaris*, $\times 14$ (after Groves & Bullock-Webster (1920: pl. 6)); 5-C, Antheridium isolated at node, enveloped in mucus, plant dioecious, *N. capillaris*, $\times 14$ (after Groves & Bullock-Webster (1920: pl. 6)); 5-D, Oogonia geminate, 2 at a node, lateral and below antheridium, plant monoecious, *N. californica*, $\times 8$ (after Allen (1894: pl. 185)); 5-E, Gametangia lacking at first branchlet division, *N. tenuissima*, $\times 11$ (after Groves & Bullock-Webster (1920: pl. 14)).

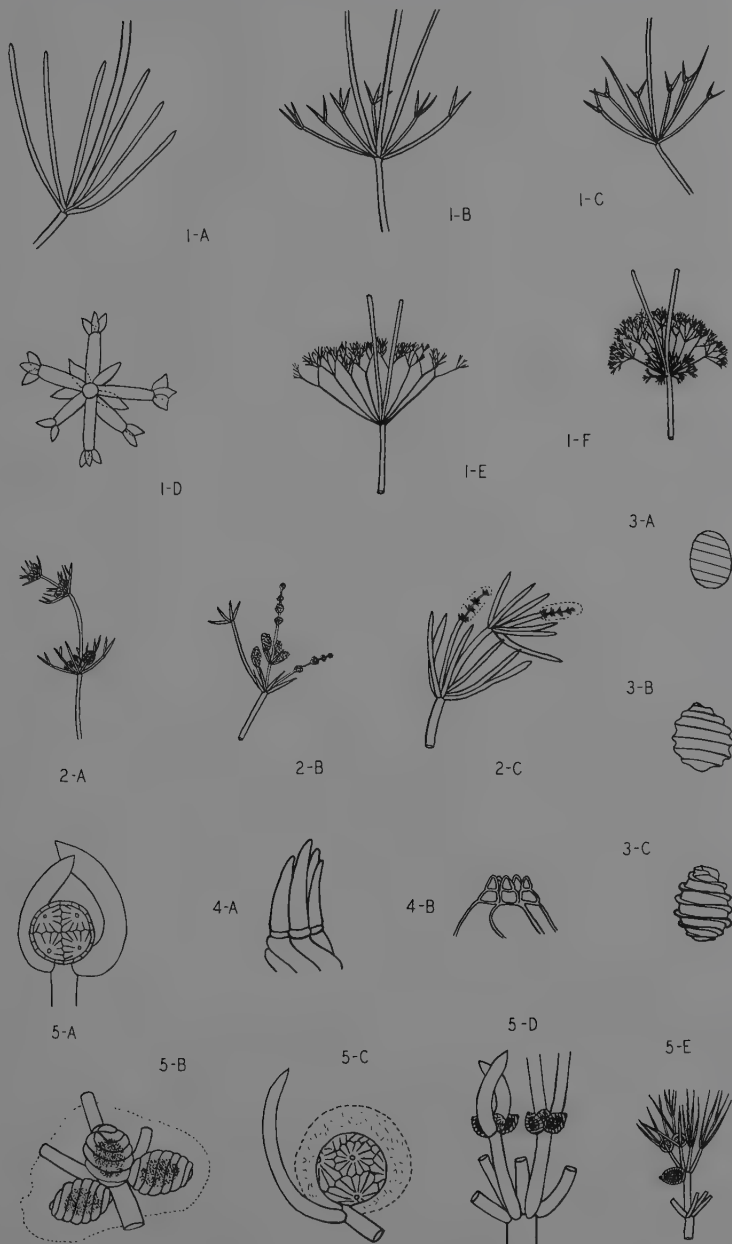


PLATE I

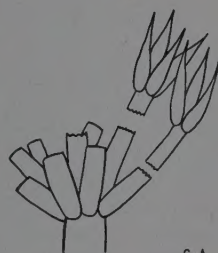
EXPLANATION OF PLATE II

Range of variation in certain characters of *Nitella*

Fig. 6-A — 6-G, Dactyls, the ultimate branchlet rays: **6-A**, Dactyls 1-celled, acuminate, *N. stellaris*, $\times 11$ (after Allen (1896: pl. 285)); **6-B**, Dactyls 1-celled, not abbreviated (cf. 6-C), *N. acuminata* var. *subglomerata*, $\times ?$ (after Braun (1883: pl. 1)); **6-C**, Dactyls 1-celled, greatly abbreviated, *N. acuminata* var. *subglomerata* f. *brachyteles*, $\times ?$ (after Braun (1883: pl. 1)); **6-D**, Dactyls 1-celled, enormously inflated, *N. clavata* var. *inflata*, $\times ?$ (after Braun (1883: pl. 1)); **6-E**, Dactyls 2-celled, mucronate, *N. microcarpa*, $\times ?$ (after Braun (1883: pl. 2)); **6-F**, Dactyls indiscriminately 2-3 celled, *N. capillata*, $\times ?$ (after Braun (1883: pl. 2)); **6-G**, Dactyls 3-or-more-celled, not mucronate, *N. capillata*, $\times ?$ (after Braun (1883: pl. 2)).

Fig. 7-A — 7-H, Apices of dactyls: **7-A**, Rounded, blunt, *N. capillata*, $\times ?$ (after Braun (1883: pl. 2)); **7-B**, Obtuse, *N. opaca*, $\times 34$ (after Groves & Bullock-Webster (1920: pl. 7)); **7-C**, Acute, *N. opaca*, $\times 34$ (after Groves & Bullock-Webster (1920: pl. 7)); **7-D**, Acuminate, *N. missouriensis*, $\times 11$ (after Allen (1892: pl. 5)); **7-E**, **7-F**, Mucronate, penultimate cell more than 3 times as broad as the base of the mucro, *N. mucronata*, $\times 24$ (after Groves & Bullock-Webster (1920: pl. 12)); **7-G**, Mucronate, but penultimate cell tapering toward apex so that the diameter of the penultimate cell is nearly equal to the base of the mucro at their conjunction, *N. gracilis*, $\times 48$ (after Groves & Bullock-Webster (1920: pl. 13)); **7-H**, Mucro a 4-cuspidate crown, *N. axillaris*, $\times ?$ (after Braun (1883: pl. 1)).

Fig. 8-A — 8-H, Oospore membrane patterns in fossae between two striae of outer membrane: **8-A**, Smooth, *N. flexilis*, $\times ?$ (after Allen (1892: pl. 6)); **8-B**, Granular, *N. Blankinshipii*, $\times ?$ (after Allen (1892: pl. 4)); **8-C**, Minute, non-contiguous tubercles, *N. capillaris*, $\times ?$ (after Allen (1894: pl. 9)); **8-D**, Coarsely granular with irregular granulations, *N. acuminata* subsp. *glomerulifera*, $\times ?$ (after Allen (1892: pl. 8)); **8-E**, Short, rather rectangular elevations or ridges, *N. Macounii*, $\times ?$ (after Allen (1894: pl. 14)); **8-F**, Irregularly reticulate, *N. Bastini*, $\times ?$ (after Allen (1894: pl. 10)); **8-G**, Reticulate, *N. mucronata*, $\times 194$ (after Groves & Bullock-Webster (1920: pl. 5)); **8-H**, Beaded reticulate with 4-5 reticulae per fossa, *N. transilis*, $\times ?$ (after Allen (1896: pl. 23)).



6-A



6-B



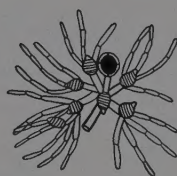
6-C



6-D



6-E



6-F



6-G



7-A

7-B



7-C



7-D



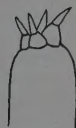
7-E

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7-G

7-H



8-A

8-B

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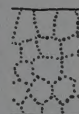
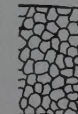
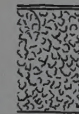
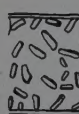
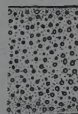
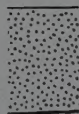
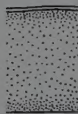


PLATE II

SYNONYMICAL INDEX

Names accepted on nomenclature grounds are printed in **boldface**; synonyms or misidentifications are printed in *italics*; old synonyms which have been subsequently transferred and now form part of accepted new combinations are printed in **bold italics**; incorrect usages and determinations which have subsequently been changed by later authorities are printed in *italics*, and indicated by "acc." (= according to) the writer who recorded the name. Accepted names of superspecific groups are printed in CAPITALS. The asterisk (*) precedes combinations which are not employed in the present work, but which may prove to be more consistent.

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